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Using 3D Virtual Worlds in new educational contexts: IT College in OpenSim

Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Comunicação Multimédia, realizada sob a orientação científica do Professor Dr. Luís Francisco Mendes Pedro, Professor Auxiliar do Departamento de Comunicação e Arte da Universidade de Aveiro

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o júri

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OpenSim, Mundos Virtuais, Educação, Web 2.0, Estónia, Processo de Bolonha

resumo

As instituições europeias de Ensino Superior, bem como cada agente envolvido nos processos formais de aprendizagem do Ensino Superior, estão actualmente a experimentar profundas mudanças sob as directivas do Processo de Bolonha.
Ao mesmo tempo, as instituições recebem uma nova geração de estudantes, com fortes competências tecnológicas, sendo necessário a estas a compreensão de quais as ferramentas a integrar no currículo educacional, de forma a corresponder às necessidades e expectativas dos seus estudantes.
Esta reforma educativa toma lugar enquanto a World Wide Web evolui para a "Web 2.0": um conjunto de ferramentas tecnológicas e serviços impregnados de princípios como a colaboração, a faceta social e a centralização no utilizador. E novas tendências na Web começam a aparecer, através de paradigmas como os Mundos Virtuais 3D.
Esta investigação procura primeiramente compreender como desenhar e construir espaços e ferramentas dentro do Mundo Virtual 3D OpenSim que sejam adequadas às novas realidades educativas e sociais; e adicionalmente, procura que este conhecimento seja usado na criação de uma presença no OpenSim para o Eesti Infotehnoloogia Kolledž, uma instituição de Ensino Superior estoniana. As características do IT Kolledž serão obviamente consideradas durante o processo de investigação.

keywords OpenSim, Virtual Worlds, Education, Web 2.0, Estonia, Bologna Process

abstract

European Higher Education institutions, as well as every individual involved in higher education formal learning processes, are currently undergoing profound changes under the guidelines of the Bologna Process.
Simultaneously, institutions face a new wave of technological-savvy students and are demanded to understand which tools to integrate in educational curricula in order to adapt to their expectations and needs.
This whole educational reform takes place while the World Wide Web evolves into "Web 2.0": a set of technological tools and services impregnated with collaborative, social and user-centered attitudes. And new Web tendencies start to unfold, comprising paradigms such as Virtual 3D Worlds.
This research aims firstly to understand how to design and build spaces and tools inside 3D virtual world OpenSim that will be adequate in new educational and social realities; and secondly, to use this knowledge to create an OpenSim presence for Eesti Infotehnoloogia Kolledž, an Estonian higher education institution. IT Kolledž's characteristics will be obviously considered during the research process.

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1. INTRODUCTION AND CONTEXTUALIZATION

This document is a report of a research project in the area of virtual worlds design and implementation. It concerns the planning, conceptualization and development of the virtual world's presence of the Infotehnoloogia Kolledž (ITK) in Tallinn, Estonia.

This research project was conducted under the Master's Degree on Multimedia Communication of the University of Aveiro, under the modality of a mobility research project. The author of this document has, therefore, conducted the project in two different phases in what logistics and places are concerned. The first one, more connected to the pre-conceptualization, was done in Aveiro, Portugal, and the second one, focused on the actual conceptualization and development, was done under the Erasmus protocol in Tallinn, Estonia, in ITK.

1.1. Research problematic

The research project problem focuses on the usage of new technologies in educational contexts, a reality that appears to be commonplace in higher education institutions on a global scale. Electronic tools, especially those that make use of Internet connectivity, or are totally online, are nowadays an active part of the strategies of educational institutions, teachers and students, covering several tasks and parcels of the educational process.

Nonetheless, this massive usage might only make sense if we are able to find in them true advantages to the educational process. Teachers and students should face the variety of tools included in what is now described as '*e-Learning*' as allies in the development of their skills and knowledge. But, to what extent is this truly done in real-life situations?

The constant change in the technological scene, where new services and tools appear every day, is usually followed by the attempt of using them in classrooms and apply them to educational curricula. But it is arguable that a new technology, no matter how exciting or innovative, should overlap the needs presented by the learning process agents.

An additional topic related to these questions refers to the profound changes in the roles of both teachers and students (Wake, Dysthe & Mjelstad, 2007). There seem to be new expectations and needs on the students' side, especially with the appearance of a tech-savvy generation that requires the adjustment of higher education institutions. At

the same time, global markets and increasing competition demanded these institutions to conduct major changes at several levels.

The Bologna Process appears as a by-product of this dynamic context. Its guidelines are new variables that need to be extremely well adapted to particular countries and institutions. Now, more than ever, teachers and students may face new roles and challenges. How will the technological scene adjust to these needs? Will it affect the roles of educational agents?

The relationship between technological and educational trends is therefore one of the main approaches of this research project. In order to create an educational tool, it does not appear to be enough to make it available to individuals or communities that might not be predisposed to accept them: the correct approach demands an understanding of the reasons for the creation of these tools and their adjustment to the reality faced.

It also appears necessary to understand the technological context of the selected platforms. In this particular research case, we will try to understand the reality in which three-dimensional virtual worlds appeared, evolved and their current state of development and usage, as well as the reason to approach them as an advantage to educational contexts.

Additionally it is also necessary to consider the specificities of their target public. Although the Bologna Process presents a European-wide nature, only after the thorough study and comprehension of the agents towards which the platform is destined should we start an implementation process that might answer the public's actual needs. Therefore we will have to consider the particular characteristics of the institution where this research will take place. Specifically, it's position inside the Estonian educational panorama and the needs and expectations of its students and teachers.

Therefore, the main approaches in the theoretical framework of this research will evolve around educational needs under the Bologna Process, 3D Virtual worlds and their technological context to fit the particular case of IT Kolledž in Estonian educational reality.

1.2. Research questions

According to the characterization of the research project, a number of research questions were created, to which the project will try to find the appropriate answers. These questions attempt to be the starting point of the research, the guidelines towards

which the project converges and evolves. They attempt to be clear, achievable and pertinent (Quivy & Van Campenhoudt, 1998).

"– What implications has the Bologna Process brought to the educational agents?"

"– How can three-dimensional virtual world implementations aid the learning process?"

"– What is the place of the ITK in Estonian education, how has it adapted to the Bologna Process and which electronic tools does it use for educational initiatives?"

"– How to create a virtual world presence for educational initiatives, according to the case of the ITK?"

The choice to decompose the research problematic in four different questions is based on the number of key-vectors that are covered by the research project. An attempt to encapsulate them into one question could create the risk of blurring the project's guidelines and difficult the course of the research process.

1.3. Research project goals

The ultimate goal of the research project hereby described is the creation of a virtual world presence for the Estonian Higher Education institution IT Kolledž. The deconstruction of this final goal can lead to the subdivision into several secondary goals.

- Development of a comprehensive theoretical framework concerning Technology Enhanced Learning, Estonian educational reality and the state-of-the-art panorama of Virtual Worlds.
- Understanding the reality of the ITK through the conduction of studies and observation of its target audiences.
- Developing a conceptualization and development plan, and ultimately helping to develop an ITK virtual world implementation.

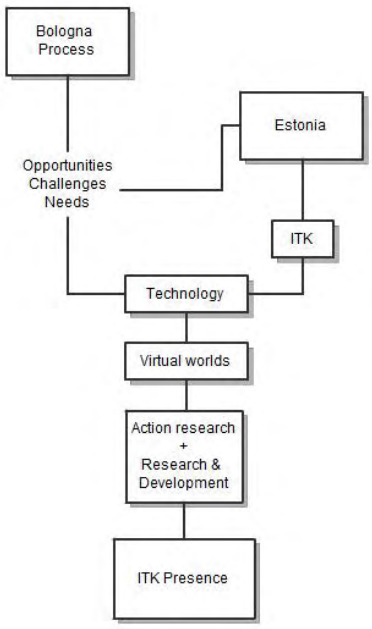

Chart 1 - Research modules

2. THEORETICAL FRAMEWORK

2.1. Education under the Bologna Process

2.1.1. Reformist needs

It is defended that the reform of higher education systems in Europe became an obvious need in the end of the 20th century, especially due to the need to answer the global education "market" demands and the necessity of raising competition inside it (King, 2008).

It is inside this reformist context that the Process of Bologna Agreement appears. It is constituted by a group of agreements signed by the large majority of European states (twenty-nine of them initially, expanding later to a total of forty-six).

The proposed objective was, primarily, the *"harmonization of the architecture of the European higher education system"*, as stated in the Sorbonne Joint Declaration (Sorbonne Joint Declaration, 1998), signed by the French, German, Italian and British Ministers for Education, one year before the Bologna declaration and considered to be its foundation.

The educative transition started in 1999, with the declaration signing in the Italian city of Bologna and the establishment of the deadline for the adoption of its guidelines by the Higher Education institutions in 2010.

The goals of the Bologna Process cover several areas of Higher Education, but focus mainly on the transversal uniformity of the learning process on a European scale, in order to facilitate student mobility and curriculum interpretation and comparison, and to promote competition among institutions (Nóvoa, 2002). As a final goal, and making use of these guidelines, it is intended to create the European Space of Higher Education (ESHE), a common reality to all European members with goals defined under the Bologna Process and subsequent agreements (van der Wende, 2000).

2.1.2. Changes in the Educational System Model and in the Credit System

The creation of the ESHE has as one of its main goals the increased transparency in curriculum interpretation from one state to another (Message from Salamanca, 2001). In order to allow this objective to be true the need to promote a common educational system to all institutions was felt. The desired result would be the possibility to compare

curricula or understand which skills an individual possesses, relating to his academic diploma, in whichever country he is located at.

The chosen system model was the one used by Anglo-Saxon institutions. It is divided in three fundamental degrees:

- 1: *Bachelor's Degree:* Awards between 180 and 240 ECTS, in a normal study period of 3 years.
- 2: *Master's Degree*: Awards between 90 and 120 ECTS, in a normal study period of 2 years.
- 3: *Doctoral Degree*: No typical value of ECTS; normal conclusion period is around 3 years.

In order to assure a reliable interpretation of students' and graduates' skills, the promotion of the European Credit Transfer System (ECTS) throughout higher education institutions as the inter-institution equivalence recognition system was conducted. Through the generalized and common use of this system it is intended to promote an increased transparency and understanding on students' mobility, allowing therefore a larger degree of ease on the implementation of an open European higher education space (Message from Salamanca, 2001). It also minimizes constraints of space or time distance related to the competences authentication process, when this is finally made through the accepted common credit system (Prague Communiqué, 2001).

The new credit and education system models may present fundamental relevance to the recognition of students' skills, but they also may demand the change of the practical focus of the educational paradigm as a *sine qua non* condition for a successful European mobility system.

Even though the Bologna Process and its formal mechanisms can provide transmissibility and mobility of people and knowledge, it needs to be followed by drastic repercussions in the way students work and organize their studies (Hortale & Mora, 2004). It's generally accepted that these changes (more or less dramatic) influence student, teacher and institution's roles in higher education contexts.

2.1.3. Change in Higher Education's main goal

The Bologna Process brought a fundamental change to the higher education system, as the goal of the whole process is no longer the transmission of knowledge from teacher to student. The implemented processes' intent is to change the way the student is faced

– they shouldn't be looked at as a repository of concepts, transmitted by a single entity, the teacher (Hortale & Mora, 2004).

In this new educational context, the student is charged with a larger degree of responsibility in his educational development. The focus is more on the development of his skills, allowing him to possess a larger theoretical and practical learning ability on a long term (Hortale & Mora, 2004). The acquisition of knowledge appears therefore more dependent on the student's individual actions, with constant support and orientation from the teacher. This new tendency also translates itself in a larger number of practical projects and experimentation in the specific field of study of each degree.

2.1.4. Transversal Competences

The valorization of the development of the student's individual competences focuses not only in the specific skills of each study field, but also in a range of more general aptitudes, that are outside the border of individual degrees, but which are fundamental for each student to possess the autonomy, self-learning and work organization skills that the Bologna Process demands (Gonçalves de Freitas, 2006).

These horizontal (or transversal) competences have a reflex in the study plans and assessment, in parallel with the specific skills of each field of study. They are transdisciplinary and of diverse types: inter-personal communication, instrumental or systemic knowledge, ability to manage work and time, team work skills and community integration, use of new technologies or language skills (Tynjälä et al., 2006).

This range of competences, arguably not very much valued by educational plans until recently, may now present a crucial importance, especially considering that one of the main goals of the Bologna Process is, as already referred, to facilitate mobility inside the European Space of Higher Education. It is also a group of skills that may present a lot of importance inside the work market, especially in areas where time scheduling and working processes might require more flexibility and adaptation.

2.1.5. Lifelong Learning

The sort of competences described above may present advantages not only on an immediate level, but also on a lifelong level – something the Bologna Process also intends to promote, in the context of 'Lifelong learning'. It was especially stated in 2001 through the Prague Communiqué, a follow-up to the Bologna Declaration relating to the

creation of the European Space of Higher Education. The Ministers of country members referred:

"Lifelong learning is an essential element of the European Higher Education Area. In the future Europe, built upon a knowledge-based society and economy, lifelong learning strategies are necessary to face the challenges of competitiveness and the use of new technologies and to improve social cohesion, equal opportunities and the quality of life." (Prague Communiqué, 2001: p. 2)

The valuing of transversal competences takes place in this idea of constant competence updating and reinforcement. General skills are therefore faced as essential, constituting indispensable mechanisms for constant learning and increased competitiveness (Descy & Tessaring, 2001). These competences are permanent and allow a constant knowledge updating, avoiding the outdating of specific competences.

Electronic tools are used as important allies for learning processes, as described in this document. Therefore, in order to understand how they can be applied for such purposes, it is indispensible to present their history under educational contexts.

2.2. Technology Enhanced Learning

2.2.1. The origins of e-Learning

The usage of electronic tools in education – a practice which has become known as e-Learning (*electronic learning*) – can be traced historically all the way back to the 70's. It started to appear shortly after the creation of ARPANET, in 1969, by the United States Department of Defense, which was the concept of computer network which would set the roots for what we now know as Internet.

Just two years later, in 1971, the world would witness the creation of the first tools that would serve a pioneer usage in education: electronic mail inside the ARPANET (Hafner & Lyon, 1996), and, more community related, computer-conferencing – "*any system that uses the computer to mediate communication among human beings*" (Hiltz & Turoff, 1978) – through EMISARI.

These two tools are intrinsically different in their nature. E-mailing constitutes itself as a means of communication "one-to-one" or "one-to-many", whereas computer-conferencing is essentially related to group communication (Vallee *et al.*, 1978), where the dynamic of the group itself and the idea of collective intelligence appear as key-elements (Harasim, 2000). These elements, so commonly used nowadays, were already

considered in this initial stage of computer networks, as referred by Hiltz & Turoff (1981), and would have more visible feedback upon the evolution of global networking, a phenomenon which will be further analyzed in this research.

It was in the middle of the 70's that the first electronic communication tools (e-mail and computer-conferencing) started to be used in computer networking for educational purposes (Harasim, 2000). They played a secondary role in the curricula, when compared to the traditional learning processes, but their progress was visible, as in the beginning of the 80's there were already courses online-mediated in their entirety.

It was with the launch of TCP/IP standard, though, in parallel with the creation of the World Wide Web and hypertext by Tim Berners-Lee at the CERN in 1982 that the global network would shape up the way we know it today.

2.2.2. Web-based learning

During most of the 90's, even though the World Wide Web and online networking were already a growing reality, the preferred support for delivering educational content was the CD-ROM (Diaz, 1999). It is a support very limited in what reciprocal communication and content updating possibilities were concerned, but much more accessible to target-publics during this phase. Only in the second half of this decade did Web contents started to position themselves as a viable alternative.

The reasons for this fact are not only related to the obvious limitations of offline media, but also with the growth of the Web in this period. It was then that multimedia contents started to become more appealing in the Web, combining a multiplicity of media (audio, video, text…) with interactivity, not only with the computer terminal but also with other network users (Passerini & Granger, 2000). Therefore, the combination of updatable content and multimedia characteristics with electronic communication tools, either synchronous or asynchronous, made the World Wide Web the preferable platform for educational content and phenomena.

The most common Web-deployed method were Learning Management Systems (LMS), which became common-place among Higher Education institutions (Paulsen, 2003). These are platforms that congregate educational contents, communication tools and learning-process management and assessment. In practical terms, the integration of online educational multimedia content in these systems constituted them, in the eyes of many educational agents, as extensions to the traditional classroom.

Another reason for the rising importance of the Web in e-Learning was the democratization of Internet access. As Internet access prices started becoming increasingly accessible to general population, the creation and promotion of educational projects that used online components became much more sustainable, and distance learning grew exponentially ever since. Additionally, the reduction on Internet access terminals, especially concerning laptops, and the vulgarization of public access points, using WLAN technology and vulgarly know as Wi-Fi hotspots were also behind the new paradigms of learning (Georgiev et al., 2004).

Additional factors of *sine qua non* importance for this transformation from offline to online contents lie in the evolution of the infra-structures over which the Internet is founded. The dramatic increase of the access speed of Internet connections, especially residential ones (Crandall *et al.*, 2007), allowed a fast access to multimedia content, including typically larger files such as video or audio content, which would be unusable with slower transfer speeds. The very way of facing an online connection evolved, from dial-up connections of limited speed and reliability to always-on broadband services. Therefore, the availability of online content was finally comparable to that of offline supports, with the advantage of updatability and use of synchronous and asynchronous communication tools.

With the growth in the number of Web users and the democratization of access to technologies and equipments, the way online communication and contents are faced and used has also started to change. The use of an online platform simply for hosting and managing contents is hardly considered, by itself, as a huge advantage for educational purposes. However, the communication tools started to show, progressively, the growing trend of social Web components and distributed online communities.

This trend was very much in consonance with the idea defended by Hiltz & Turoff (1978), two decades before, concerning the need to incorporate group dynamics and collective intelligence in online applications. At the same time, the idea of openness of information and knowledge sharing (especially in education) pushed forward a new mentality and attitude inside the Web: the “Web 2.0” concept was born.

2.2.3. Web 2.0

The use of the “Web 2.0” buzzword wasn’t well received by Tim Berners-Lee, the creator of the original concept of the Web. Berners-Lee disagrees with the implicit concept of phase separation that the Web 2.0 expresses. In his opinion, the new Web

tools are only a follow-up of the pre-existing Web, and the social and collaboration spirit were always a part of it:

"Web 1.0 was all about connecting people. It was an interactive space, and I think Web 2.0 is of course a piece of jargon, nobody even knows what it means. If Web 2.0 for you is blogs and wikis, then that is people to people. But that was what the Web was supposed to be all along. And in fact, you know, this 'Web 2.0', it means using the standards which have been produced by all these people working on Web 1.0." (Berners-Lee *in* Laningham, 2006)

Indeed, Berners-Lee has been an early supporter of the Web as a collaboration and participation environment, a fact most evident in the tools he developed in CERN, such as "Enquire", a project management collaborative tool, and a browser that allowed the visualization and editing of HTML called "WorldWideWeb" (Berners-Lee & Fischetti, 1999).

But, in practical terms, this typology of tools was abandoned or forgotten for the most part of the Web's existence. The reasons for this fact may rely on the lack of standards (technological reasons), or the lack of maturation of the Web and its users (social reasons). It is perhaps in the evolution of this two types of reasons that the buzzword "Web 2.0" may, eventually, make sense: a maturation of the Web's culture and technology which allowed a whole new range of social devices, participative community creation and collaborative and participative content creation.

In this context it is important to make an allusion to Tim O'Reilly. As founder and CEO of O'Reilly Media, he was a privileged observer of this new tendency. It was Dale Dougherty, vice-president of O'Reilly Media, who first used the term "Web 2.0", in 2004, during an internal meeting of the company (O'Reilly, 2005); Tim O'Reilly consolidated the expression through a paper called *"What is Web 2.0: Design Patterns and Business Models for the Next Generation of Software"*. In this document he defined the new Web experiences and presences that constituted examples of this Web evolution.

The discussion concerning the "Web 2.0" buzzword is, in the end, of questionable importance. It might be, then, an obvious continuation of the 'first' Web, as defended by Berners-Lee, since it is supported by the technologies and standards created during its existence, and as such is inseparable from it. But the "2.0" moniker does not imply a separation from the original Web, but an evolution. The Web appears to have evolved to its original goal and philosophy, due to the maturation of its culture and user-base, which allowed the creation and popularization of new tools. It was probably the evolution of these tools that justifies, in a more consensual way, the use of the moniker.

2.2.4. The '2.0' tools and ideas

The tools that fit in the Web 2.0 paradigms are, in current days, seemingly countless. The majority makes use of technologies and standards with a long history, and constitutes new services applied over those technical foundations.

The 2.0 services or tools are generally showcases of integration capability. The idea of *mash-up*, meaning the mixing of tools to create richer content and services, is one of the strongest features of the 2.0 culture (Miller, 2005). In a certain way, we can call it the 'embed-culture': the most successful services are generally those who allow their extensibility outside of their websites or proprietary platforms. Let's take for example the video hosting and sharing platform YouTube: although it was a pioneer platform regarding ease of use (facilitating processes which were previously much more technical, another of Web 2.0 characteristics worth of mentioning), perhaps its most important feature was the possibility of embedding videos in any other external page or website, creating content ubiquity and flexibility.

The *mash-up* idea also has direct implications on the creation of services that make use of other platforms to simplify processes or create totally new ones. For example, combining the use of an online maps service such as Google Maps with the insertion of geo-referenced images from other service such as Flickr results in the creation of a whole new service, founded over platforms that are 2.0 tools themselves.

Another of the main focuses of the 2.0 idea is user-centrality (Anderson, 2007). The new services must be easily and naturally usable by anyone, even if they don't possess technical know-how. For example, the technology that supports blogs or podcasts isn't necessarily new (the 'blog' concept goes all the way back to 1997, created by Jorn Barger (Blood, 2002; Doctorow *et al.*, 2002), and blogging-like activities existed in the mid-nineties already), but it was the ease of use and free availability to end-users, concerning content creation and edition, that made them ubiquitous on the Web, all due to the removal of the technical know-how need layer for the end-user.

As a result, user-generated content became the most important part of the Web, not only relating to blogs, but also to a varied range of other multimedia content (Anderson, 2007).

Obviously, the interaction and social component over these contents were equally essential. As a matter of fact, the "social Web" moniker became almost a synonym of Web 2.0. As a result, Web 2.0 tools are crammed with tools that allow discussion,

content rating (mostly by peer users) and the creation of communities. A blog is different from a simple personal page especially because it allows a bi-directional communication, where users give and receive *feedback* related to the created content. And new content will necessarily be affected by the intervention of the community.

The idea of community is necessarily connected to the concept of collective intelligence and knowledge (Lévy, 1994). These concepts are mostly visible in tools such as wikis, with *Wikipedia* as the most visible example.

The power of this tool lies precisely on the open editing of information, allowing a virtually endless number of editors. Therefore, anyone can add or update information concerning any subject, and collaboration is a key element. This is also the reason behind the creation of internal wikis in many corporations and institutions: a resource that powers intra and inter-institutional intelligence, while simultaneously developing individual skills and knowledge.

It is also important to address another concept: even though user-generated content is one of the most striking features of Web 2.0, a very important one resides in user-targeted content as well (Hoegg et al., 2006). For example, the Amazon portal suggests users new products based on their history of shopping and visualizations, meaning the content gains added value when it is targeted to the user, and not the other way around.

Another tendency that Web evolution presents is the usage of standards that allow the separation of content, design and access terminals. Using standards such as XML and derived technologies, such as RSS (Really Simple Sindication) feeds, it is possible to separate content formatting from actual content, allowing the adaptation to any platform of access (Hammersley, 2003). This phenomenon gains additional importance with the rising use of mobile Web-access terminals, which require additional care relating to content formatting.

2.2.5. The Future of Web: 3.0?

Besides the available resources and tools used by the 'traditional' Web, that use the most common standards (HTML, XML, Ajax, Javascript, etc.), new tendencies start to appear, attempting to establish themselves as the future of the Web; these new waves make use of different media and paradigms.

So, in an environment where even the moniker "Web 2.0" is not totally consensual, new waves of thinking the Web attempt to become standards. Ideas such as the semantic Web, evangelized for almost ten years by Tim Berners-Lee (Berners-Lee *et al.*,

2001), or the optimization of tools for mobile devices usage (mobile phones, smartphones, P.D.A.'s and other mobile devices) for optimized access to Web and specialized tools (such as those that make use of geo-positioning systems). Once again, Tim O'Reilly presented his opinion of this reality:

"There's definitely something new brewing (…). And it's increasingly likely that it will be far broader and more pervasive than the Web, as mobile technology, sensors, speech recognition, and many other new technologies make computing far more ambient than it is today." (O'Reilly, 2007)

O'Reilly's position is, then, considering the next evolution of the Web as a new range of tools, systems and interconnections, escaping from the conventional Web, and the way we think of it nowadays. This position is reinforced if we consider other previous opinions to O'Reilly's commentary:

"Imagine a Web without browsers. Imagine breaking completely away from the document metaphor, or a true blurring of application and information. That's what Web 3.0 will be, but I bet we will call it something else" (Boyd, 2007).

This concept of using new navigation metaphors, abandoning HTML documents and browsers may seem utopian and a long distance away. However, there are already real solutions of this evolutionary trend on the Web: the use of 3D immersive paradigms that totally changed how online browsing and interacting is done, and which will be explored further in this document.

2.2.6. Inclusion of Web 2.0 in Higher Education

The concepts related to Web 2.0 are, as we already mentioned, quite diverse and include communication, information sharing, community collaboration, socialization and service integration. The new services are aimed to the end-user, in a user-friendly way, and increase the individual's work and learning autonomy by providing universal access to information, as well as its gathering and manipulation. Knowledge is shared, becoming global and allowing an easy access and universal application.

The potential of these tools has, therefore, created a strong community of users who consider them as valuable and worthy for a number of purposes. It is therefore hardly surprising that the integration of these technologies in educational activities and curricula would occur (Anderson, 2007).

At the same time, the educational landscape values very similar ideas: community-based work, knowledge sharing, promotion of transversal competences and work autonomy, people and knowledge mobility and distance learning.

This multiple crossing of values must therefore be considered when researching the usage of innovative technological tools for educational purposes, with the purpose of enhancing the learning experience using the advantages of Web 2.0 tools (Franklin & Van Harmelen, 2007; Ebner *et al.*, 2007).

The introduction of technological tools on the educational environment is not, by itself, a guarantee of success (Hamid, 2002; Conole *et al.*, 2006). It appears to be necessary to consider the learning process as the fundamental point, and create/use technology that fits educational strategies and methodologies.

Another focus is on the new students' attitudes and expectations, especially when dealing with a strongly experienced and competent audience concerning technological tools usage. An adequate use of these tools might therefore constitute important allies, as supported by learning models based in theories such as socio-constructivism and connectivism.

2.2.7. Socio-constructivism

The modifications of teaching practices in European Higher Education institutions and the mutating roles of teachers and students seem to converge with the constructivist theory of learning. This theory has its roots in Jean Piaget (Piaget, 1936), who defended a learning theory where children are more than simple passive knowledge recipients, as an objectivist learning approach would suggest. Piaget's studies attempted to prove that children learn according to their existent knowledge and experiences, and will only refute a pre-existing theory if the new one is, in their logic, superior to that one.

Piaget's theory is the basis for many other subsequent theories in the area of cognitive development. An example is the study of its core in studies concerning learning in the adult age (Merriam & Caffarella, 1999). The core idea is the perspective that it is the individual who builds knowledge, and is an active element in the learning process (Jonassen, 1999) – it is the individual who decides what to learn (Savery & Duffy, 1996), according to his experience and previous knowledge.

According to this theory, the consideration of the teacher as a simple transmitter of information blocks, and of the student as a passive receptor, might be an inadequate approach. Learning appears to be, fundamentally, an indirect process, in which individual

interpretation plays a key role, and where most of the knowledge results from the acquired experience over the interaction with the individual's social and cultural environment. Therefore, the creation of learning environments that allow manipulation and experimentation appears as an adequate response (Cognition and Technology Group at Vanderbilt, 1993; Duffy & Jonassen, 1992).

The evolution of learning theories based on the constructivist approach evolved eventually, considering additional variables. The variable related to the environment of the learner was focused by Lev Vygotsy (Vygotsy, 1978) in the creation of the socio-constructivist model.

Socio-constructivism approaches socialization as a key part of the learning process. Besides facing the learner as an active part of the process, it also considers other individuals, as well as cultural aspects, as fundamental parts of the cognitive development process. A direct example is the process of learning through modeling (Bandura, 1971). In essence, the individual is not isolated while learning, instead interacting with other agents and their surroundings. Bandura's Social Learning Theory also considers the idea of "*reciprocal determinism*"(Bandura, 1977), meaning that the individual is affected by social agents but also affects them in a two-way dynamic.

2.2.8. Connectivism

With the appearance of new realities, especially concerning the digital age ways of interacting and communicating, the learning theories evolved as well. It is under this idea that the connectivist model appears. A very young learning theory, it was created already immersed in the actual technological panorama. Attributed mainly to George Siemens, who labeled it *"a learning theory for the digital age"* (Siemens, 2004), it considers technology as an important agent in the learning process, which has to be taken into account when formulating a learning model.

According to Siemens, the concept of connection is the key. Not only does the human being learn through the creation of cognitive connections, but also through connections with other agents and knowledge sources (which might not be human) (Siemens, 2004). Therefore, the creation of networks is crucial for the learning process, with nodes and connections as its elements, with different importance and relationship connections.

Another main idea defended by Siemens is the fast and ever-changing nature of the learning process in the digital era. This idea fundamentally supports a learning attitude in

which learning to learn is fundamental. *"Know-how and know-what is being supplemented with know-where (the understanding of where to find knowledge needed)."* This perspective is also the idea behind the already presented concept of Lifelong Learning, a main key in the Bologna Process.

The consideration of technology as an active agent in the learning process is also fundamental in connectivism. Siemens defends that technology is now the support for several parts of the learning process that were previously done by humans, or even supporting previously non-existent processes. At the same time, technology alters the way the brain works, and therefore shapes and modifies the entire cognitive development process.

2.2.9. New learners, new tools

According to the explored learning theories and approaches, the learning process is nowadays a social process, where the individual is active and passive, affects and is affected, and where technology effectively changes the way we think and create knowledge.

Therefore, Web 2.0-labelled tools appear to be a reflex of effective changes in human behavior and cognition, our relationship with technology and how we use it for achieving and altering knowledge, and creating connections with other nodes in the social networks we develop in several aspects of life.

The ideas behind social web might then be no less than an obvious evolution. At the same time we evolve in our complex relationship with technology and others, the tools appear to follow a parallel path.

It is in this logic that a choice toward the use of platforms such as three-dimensional virtual worlds was made for the present research. As tools that are formatted in a new way, both in their content and interaction metaphors, they might constitute an example of new tools with potential for fulfilling the needs of new learners.

But virtual worlds have a relatively (and perhaps surprisingly) long past for a cutting-edge technology. Even though they are three-dimensional on present days, there is an extensive history and evolution behind the virtual environments we know today which we will explore in the following chapter of this document.

2.3. Virtual Worlds

2.3.1. The origins of Virtual Worlds

The origin of digital virtual environments is frequently linked with the popular board game “Dungeons & Dragons”, launched in 1974. This game consists of a fantasy environment, a world represented by the board where fantastic characters, controlled by the player and possessing different features, interact according to a number of pre-defined rules.

One of this game’s main features is its immersive nature. Through the narration of actions, spaces and choices, players are supposed to make their moves. This game was the pioneer of fantasy role-playing games, where the characteristics of characters and environments affect the player’s actions, leading him to play specific roles inside the game environment.

The influence of Dungeons & Dragons in the creation of virtual worlds was felt in the very first of them. In 1978, Roy Trubshaw and Richard Bartle, in Essex University, create the MUD1 (Multi-User Dungeon 1) (Bartle, 1990). The word ‘dungeon’ (concerning the theme behind Dungeons & Dragons) would be forever associated with this kind of environment where the D&D game rules and elements were transposed to a networked multi-user electronic environment, in this specific case inside ARPANET.

The MUD designation would, afterwards, designate all the games of this genre, meaning fantasy games in which each player is represented by an avatar (a virtual ‘persona’ which possesses its own characteristics, mostly with a specific function inside the game – hence the ‘role’ designation), which interacts and influences other avatars and the players they represent, as well as the pre-programmed game elements (such as bots).

However, the MUD concept would become much broader the moment it was released from the strict rules and closed objectives that normally compose a game. This change would first happen in 1989 when James Aspnes, in Carnegie Mellon University, withdrew the fantasy environment (the “Dungeon”) and the game rules of a MUD (Bruckman, 1997). He then created TinyMUD, a name related to the thinning process he conducted on the original MUD source code used.

TinyMUD was, therefore, the first MUD that presented open world characteristics, without defined objectives or relevant point systems. At the same time, it offered openness unparalleled by then in what creating and altering the world was concerned. Aspnes, then, created a more equalitarian online community (Bruckman, 1992;

Bruckman, 1997), even though he acknowledges doing so unconsciously (Aspnes *in* Bruckman, 1997), and this would have repercussions in posterior virtual environments.

2.3.2. The Crucial Role of Games

Although TinyMUD was somehow successful, the most successful MUDs were those with game features, and they were the ones that introduced new characteristics and features to this sort of environment. As online communities became larger, especially concerning the number of online gamers, new designations appeared: MMO (Massively Multiplayer Online) and MMOG (Massively Multiplayer Online Game), online games which comprise a huge number of players in the same virtual universe.

The boom of this game type happened as soon as the graphical representation of more traditional virtual games was put together with online multiplayer features. Some games, such as 1987's Air Warrior or 1991's Neverwinter Nights, were very well accepted by the public. Neverwinter Nights was actually the first online role-playing game to include graphical representation, and may be considered the true predecessor of MMORPGs (Massively Multiplayer Role-Playing Games), a game typology that became truly important and won massive acceptance during the last two decades.

Eventually, three-dimensional representation also became a feature in MMOGs. During the year of 1996 the game Meridian 59 was launched. It was a MMORPG for the Windows platform, and it pioneered 3D graphics in this online game typology.

The evolution of MMOG's graphical representation happened in parallel with their maturation and establishment, from the end of the nineties till nowadays. Game titles such as Ultima Online, EverQuest or Final Fantasy XI were introduced, and, even though they required players to pay subscriptions to play them, they created communities with hundreds of thousands of players. Final Fantasy XI, for example, had 650,000 active subscriptions by the year of 2005 (Woodcock, 2008).

In present days, the leader of the MMORPG market is World of Warcraft (WoW), which, as of April 2008, conglomerated 62% of this game-type subscriptions market-share by itself (Woodcock, 2008), and a user base of around 11 million players.

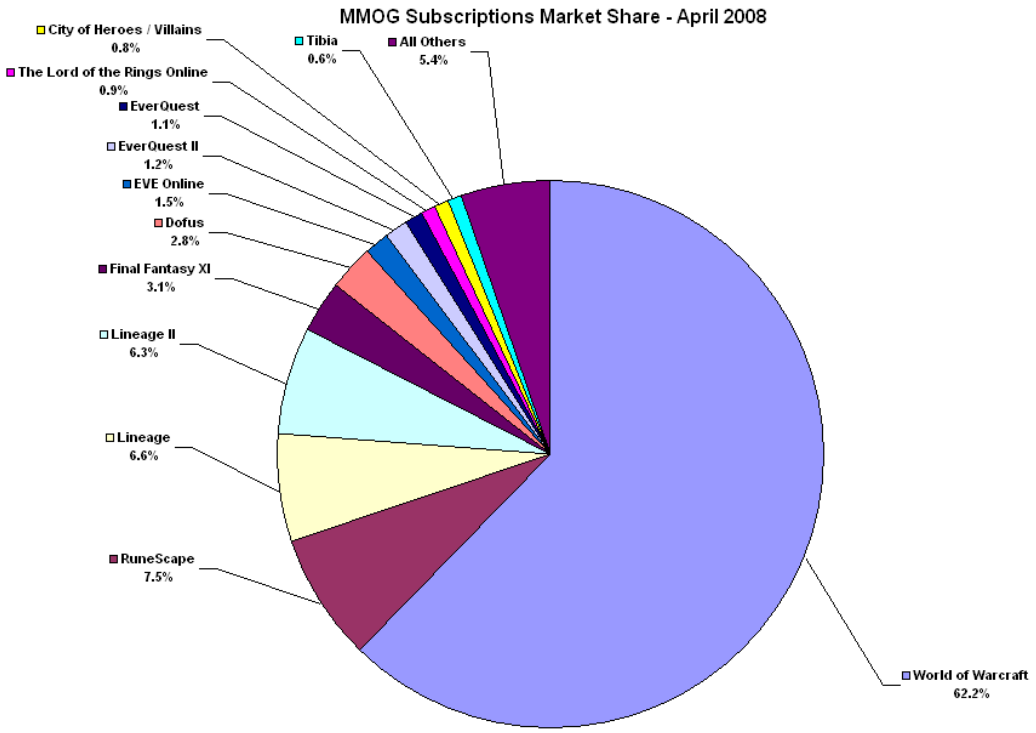

Chart 2 - MMOG subscriptions market share as of April 2008[1]

It is also interesting to notice that, even thought there has been a huge evolution since MUD1 in what gameplay and graphical representation is concerned, the theme is still pretty much similar, going all the way back to the narrative and concept of Dungeons & Dragons.

2.3.3. The Metaverse

The success of the three-dimensional Virtual Worlds typology in the gaming area is, therefore, a clear fact. However, at the same time, and in the same direction that Aspnes' TinyMUD started to point to, the MUDs without game features also had important developments.

In 1992, Neal Stephenson published the book 'Snow Crash', a sci-fi novel describing a virtual world called *metaverse* (Stephenson, 1992). The most striking features of this world were the physical reproduction of the real world, and the possibility of each participant in this alternative universe (the word *metaverse* is the combination of "meta", the abstraction of something, and "universe") using a character with a totally free appearance – an "avatar".

[1] http://www.joystiq.com/media/2006/06/010605-wowpie.jpg

Even though the concepts that Stephenson describes in the book were not totally original, especially within the sci-fi "cyberpunk" literature genre (Vinge, 1981; Gibson, 1984), they were the ones which would most influence the creation of online virtual worlds which attempted to represent reality more or less exactly. The 'avatar' designation, used by Stephenson to describe the virtual corporeal representation of a user, is still used in present days.

The first attempt to reproduce the *metaverse* in a virtual world was by Steve Jackson Games' "The Metaverse". This MOO (Multiplayer Object Oriented, a variation of textual MUDs that are object-oriented) was followed by SnowMOO. However, the closest platform to the idea of *metaverse* during the nineties was Active Worlds, launched in 1997. Making use of the three-dimensional graphics that MMORPGs introduced, this virtual environment distinguished itself by the open universe navigation features, user-created content possibility and various communication tools available to users.

2.3.4. Second Life

After the path craved by Active Worlds, Second Life was launched in 2003 by Linden Lab. It is a three-dimensional virtual world accessible through a free client-software developed by Linden Labs, and requires the creation of an account in Second Life's website.

Upon this free basic subscription, the user (or "resident", the official designation) receives a default avatar. With this avatar he may explore a vast three-dimensional world, interact with other residents, customize his virtual *alter-ego* in any way he wishes, create three-dimensional content inside the world in defined spaces for such (called 'sandboxes') and program their behavior. Second Life has a proprietary programming language, LSL (Linden Scripting Language).

Second Life also presents very particular economical characteristics. Residents can acquire Linden Dollars (L$), SL's internal currency, which allows them to buy virtual objects or terrains inside the platform. Property rights over objects created inside the virtual world are attributed to their creators, an aspect which boosted the development of the economical side of Second Life.

Communication tools available *in-world* are varied as well. Chatting between avatars is available, as well as Instant Messaging (IM) and voice communication. It is also possible, using the programming tools offered by default, to integrate external Web services, as well as access Web pages using an internal browser.

Second Life is, nowadays, one of the most successful MUVE (Multi-User Virtual Environment). The real number of users is, however, very much disputed, because many users may possess several accounts. Still, among 16 million registered accounts in the platform (as of November 2008), the number of Premium accounts (paid accounts, that have additional benefit such as the ownership of virtual land) was 79,721 and the number of log-ins in the previous 60 days to the date of consultation was 1,442,781, according to Linden Labs.

At the same time, Second Life became an interesting platform for companies of variable size and area of specialty. Some giant corporations such as IBM, Cisco, Toyota, Adidas or Nike are or were owners of significant presences in SL, through their own virtual physical spaces (called 'islands'). In most cases, their objectives evolve around access to specific target-public, marketing actions or the creation of communities around their brands (Oliveira & Zagalo, 2009). E-Commerce inside the platform has also established an interesting presence *in-world* (Bernardo & Morgado, 2009).

2.3.5. OpenSim

As Second Life gained a larger user base and grew in popularity, the number of users who wanted to use and experiment in virtual worlds but wanted to do so in an open source and free environment grew as well. A community of users tried to duplicate the Second Life functionalities, inclusively allowing the use the official Second Life client to access these virtual world server installations and the Second Life client to server communication protocol. This server platform technology was included in the project named OpenSimulator, or OpenSim. It is used primarily to run virtual worlds similar to Second Life, but it isn't limited to it.

Besides the local installation of a virtual world platform, it is also possible to connect the server to an external grid, replicating the Second Life concept of a number of islands, interconnected and part of the same 'world'.

The experience of using OpenSim, considering it can use the SL client and is visually similar to it while running SL-style virtual worlds, is quite comparable to the Second Life platform. The main differences seem to appear in technical limitations which OpenSim still presents, functionalities that aren't yet replicated or platform stability. Contrary to Second Life, in order to possess virtual 'land' in OpenSim it isn't necessary to pay monthly or yearly fees to a company. In Second Life the owning of a parcel or island of 'land' is commercialized by Linden Lab. OpenSim islands also remove some of the

constraints imposed by Second Life, such as the limit of avatars in one island at a given time.

Finally, the interconnection of Second Life and OpenSim has been addressed for a while; an ideal situation would allow the transposition from an SL island to an OpenSim one seamlessly, using a unique avatar, as well as the transmission of objects, inventories or currency. At the date of the writing of this document this possibility wasn't yet accomplished, but the possibility of using the same avatar in SL and OpenSim was possible. Even so, the activity of the OpenSim community appears to be constant and it this reality is a possibility in the near future.

2.3.6. Education and science in Second Life and OpenSim

Educational and scientific actions are also very much present inside the virtual world of Second Life. A large number of renowned institutions on a global scale decided to create presences in-world, conduct experiences or make partnerships inside SL. For example, a 2007 study showed that at least 80% of higher education institutions in the United Kingdom had conducted some kind of educational or research action in Second Life (Kirriemuir, 2007).

Among the hundreds of institutions on a global scale that use SL is the Harvard Law School, through the 'Berkman Center for Internet and Society'. The SL presence they created serves several purposes, especially the conduction of simulations and role-playing around simulated trials. Incorporating virtual worlds in curriculum is a typical usage as well. The Glasgow Caledonian University, through its School of Engineering and Computing, conducted a trial on using Second Life as a teaching aid for the curriculum in Computing (Trinder & Moffatt, 2009), creating a visualization system related to artificial intelligence purposes, and simultaneously understanding the teaching potential of virtual worlds.

Experimentation in medical-related areas has been one of the areas to research in virtual world platforms. Simulations of clinical situations have been conducted by the Medical Faculty of the University of Auckland, reproducing behaviors and procedures in a hospital environment using Second Life (Diener, Windsor & Bodily, 2009). This institution is also involved in the creation of New-Zealand's National Virtual World Grid, using OpenSim.

The University of California in Davis uses its space to conduct experiences in the area of psychiatry, such as the conduction of studies concerning the thematic of

understanding hallucinations. The activities simulated sound and visual hallucinations of patients with schizophrenia (Yellowlees & Cook, 2006). The researchers considered that this sort of activity was proficuous in the understanding of these hallucinatory phenomena. Other research experiences in the same area (health and medicine training) have been common in Second Life (Boulos, Hetherington & Wheeler, 2007).

Behavioral studies concerning the idea of avatar and perception of "real" and "virtual" personality have also taken place using Second Life as its platform, exploring the consistency of personality traits between both realities (Aas, Meyerbröker & Emmelkamp, 2009).

University of Leicester, through the MOOSE Project (MOdelling Of Second Life Projects), is also researching Second Life's educative potential through socialization and information exchange in-world (Wheeler & Salmon, 2008). Art and media students are, for example, learning Digital Photography concepts inside Second Life, using the strong visual component of the platform. This institution also established partnerships with institutions such as London South Bank University, in particular with the Art and Social Sciences Faculty. Arts-related projects are quite common inside virtual worlds, making use of the freedom offered by these platforms, as well as the democratization of creative production allowed by worlds such as Second Life (Chávez-Aguayo, 2009).

The freedom offered by SL in creating environments and navigating inside them allows also the creation of spaces that reproduce past historical contexts (useful in history courses), augmented realities (useful in electronics, biology or medical contexts) or physically distant buildings and environments (useful in art or geography). SL's physics' engine allows the creation of meteorological or geological simulations as well. And the freedom of configuration that OpenSim allows, compared to Second Life, allows changing conditions such as gravity, which allows for experimentation of scientific nature (Farr, Hut, Ames & Johnson, 2009)

At the same time, some institutions, of a more specific or technical nature, such as language schools (Stevens, 2006), found in Second Life an ideal platform to reach a wide public, using innovative and immersive means. Initiatives such as LanguageLab (Erard, 2007), created by David Kaskel, of London's King's College, constitute examples of this practice. Other institutions followed its steps, such as the Goethe Institut, Instituto Cervantes or the British Council.

One of the most remarkable educational presences in Second Life is the New Media Consortium (NMC). With a vast number of islands to support educative research activities, this consortium of more than 250 educative institutions aims to explore the

new possibilities for education in platforms such as Second Life (Swanson, 2007). Similar initiatives using OpenSim have also been implemented, such as OpenHabitat[2], a co-operation between the University of Oxford, the Leeds Metropolitan University, the Kings College of London, the Essex University and one consultant from the University of Prince Edward Island. This project aims to create guidelines and models on the ideal ways to teach, learn and collaborate in MUVE's, as well as how to develop tools and services. Courses involved range from Art, to Design or even Philosophy. Edinburgh University conducts a similar experiment, designated OpenVue[3].

Knowledge building and sharing in Second Life, as a social and collaborative platform it is has also been studied (Loureiro & Bettencourt, 2009), in areas such as graphic and game design teaching (Pereira, 2009). It is attempted to understand the added value brought by virtual worlds to the learning process, besides the typical classroom approach to the learning process, and at the same time to understand how to actually implement solutions that help the learning process inside virtual worlds such as Second Life (Louro, 2009)

[2] http://magazine.openhabitat.org/
[3] http://vue.ed.ac.uk/openvue/

3. RESEARCH METHODOLOGY

3.1. Introduction and research problematic

The research project described in this document attempts to solve a fundamental problem: how to conceptualize and create a virtual world presence for the Estonian Higher Education institution Eesti Infotehnoloogia Kolledž of Tallinn.

The research project was conducted under an exchange program between University of Aveiro, the home institution of this document's author, and the IT Kolledž (ITK) of Tallinn. It was offered as a research option under Erasmus mobility for the conclusion of the Master's Degree in Multimedia Communication, area of Interactive Multimedia, of University of Aveiro.

The research project was planned with two distinct phases, due to the geographical constraints of both poles of the research team, Tallinn and Aveiro. The first one, conducted from October 2008 until December 2008, concerned the bibliographical information gathering and analysis and the pre-conceptualization phase.

During this period, the author of this document was developing these phases in University of Aveiro, under the supervision of the coordination team of the Master's degree. It was mostly related to theoretical and documental analysis and study, and at the same time, the communication between Aveiro and Tallinn teams was conducted using electronic communication tools. These communications also had the goal of planning the second phase of the research. Any data gathering tools and techniques used during this phase were also limited to distance deployment.

After the first phase, and beginning in January 2009, the author of this document would conduct the actual exchange period in Tallinn, Estonia. After one month of Estonian language and culture learning, the conceptualization phase would begin in the physical space of the ITK. It would be necessary to conduct interviews, surveys or meetings within the internal audience of the institution, in order to complement the information gathered on a distanced basis during the first phase.

Another major issue to address during this second phase would be the specific goals the ITK would like to accomplish with the implementation of a virtual world presence. These goals would constitute dimensions that had to be addressed in the objectives of the research as well.

It would also be necessary to gather a group of students or researchers of the ITK in order to proceed to the posterior phases of designing and implementing the proposed solutions for the original problematic. The promotion of the project among the student

audience would have to be planned and undertaken in conjunction with the staff team of the institution.

At this phase, through the interaction with the institution and its agents, the research plan would be subject to change. The methodology of the project will reflect this idea and adapt through research adequate strategies.

After the conceptualization phase, it would be necessary, according to the conclusions reached through the already executed phases, to start designing and developing the actual virtual world presence. It would be necessary to help the development team on the process of getting used to Second Life / OpenSim, eventually giving some training on technical aspects of the development.

Project development would only happen if the platform was ready for development, and therefore the purchase of an island or land parcel (in Second Life) or installation of a server (in OpenSim) would have to be a finished process by the beginning of this phase. The development process itself would be an always-unfinished product, subject to constant changes even after the end of this specific research project.

Finally, after the achievement of specific goals for development, near the end of the exchange program period, a testing phase was programmed, in order to understand if the implemented solutions were ideal for the goals they aimed to achieve. At the same time, the document created as the dissertation document would be ready for delivery and defense, and the author would therefore return to the home university, while the ITK would be able to subsequently develop additional projects over the implementation created, and accomplish the goals initially established.

3.2. Research questions

The questions which the research project aims to answer, presented in the introduction chapter of this document, must be framed under the project methodology, in order to better understand how adequate answers may be produced.

"– What implications has the Bologna Process brought to the educational agents?"

The Bologna Process was studied using bibliographic resources, understanding what it signifies, its components and the relevance it presents for the educational panorama of European Higher Education institutions.

"– How can three-dimensional virtual world implementations aid the learning process?"

In order to answer this question, a bridge was created between education and technology. It was considered necessary to understand how new technology appears, and how it is adapted to fit educational goals. It was also necessary to study how virtual worlds came to present themselves as possible platforms for educational initiatives, their evolution and characteristics.

Furthermore, the research presents the state of the art usages of virtual worlds, especially the ones developed using Second Life and OpenSim technology, in order to understand how they have been used successfully in education.

"– What is the place of the ITK in Estonian education, how has it adapted to the Bologna Process and which electronic tools does it use for educational initiatives?"

Considering that the ITK was an unknown institution for the author of this document, it was therefore necessary to study it as well as its target audiences. Tools and techniques such as interviews and surveys were conducted, as well as observation inside ITK itself, in order to understand how the institution fits in the particular Estonian education panorama. Subsequently, it was also necessary to understand how it has adapted to the Bologna Process and its measures, as well as which technological tools are used by the target audiences, in order to adapt future implementations to them.

"– How to create a virtual world presence for educational initiatives, according to the case of the ITK and its objectives?"

The last research question is related to the design and development of the actual presence. It was necessary to use the resources and data collected until the development phase and apply them as guidelines and needs, in order to successfully implement an adequate virtual world presence. At the same time, it was necessary to consider the ITK's own goals, according to its managing team.

3.3. Research project goals

"Development of a comprehensive theoretical framework concerning Technology Enhanced Learning, Estonian educational reality and the state-of-the-art panorama of Virtual Worlds."

This objective implies the creation of a strong theoretical background study, previous to implementation or conceptualization phases, in order to understand the several vectors implied in the research (education, technology/virtual worlds, ITK). The process to achieve this goal would have to be accomplished at a distance, during the first phase of the process.

The knowledge acquired during this phase would be connected with the data gathered in the following goal, to provide a correct approach in the final implementation goal.

Understanding the reality of the ITK through the conduction of studies and observation of its target audiences.

After the distance interactions and meetings with the ITK team, it would be necessary to conduct the research on a face-to-face basis. To understand ITK and its target audiences profiles a number of studies and techniques would be conducted, and data would be gathered. The analysis of this data would present valuable information, which would, after careful analysis, lead to important information which could achieve this goal.

Developing a conceptualization and development plan, and ultimately helping to develop a virtual world implementation for the ITK.

Using the information and knowledge acquired during the research project's initial phases, a development phase would happen. It was necessary to create a research plan, especially related to the different implementation phases and the agents needed to successfully conduct it.

This phase required the creation of a development team in order to be successful, because the implementation in virtual worlds would present a number of technical needs (designing, three-dimensional modelling, programming). It was planned that a student team would be created to support these needs.

3.4. Research project description

This section of the document will describe and analyze the options made regarding the research methodology. This process encompasses the strategic choices in order to conduct the pre-implementation studies and gather their conclusions as well as the development phase itself, with the primary goal of creating effective results and data for the creation of posterior conclusions.

In this chapter the reason for these methodological choices will also be presented, and framed under the specific characteristics both of the project and the reality of the development process.

3.4.1. Research project phases

The research project at hand was subdivided into different phases, each with a specific goal and role in the research process.

- *Project start-up and pre-conceptualization (October – December 2008)*
  Developed in Aveiro, and with the duration of three months, it comprehended the understanding of the research problem and objectives, the creation of the research questions and the specification of the vectors that compose the project.
  At the same time a number of communication events were established with the ITK team based in Tallinn, in order to pre-conceptualize the following phases of the projects, done in Estonia. The knowledge generated during this phase was mostly gathered using bibliographic research and analysis, and the data from distance meetings was logged and kept for posterior analysis.

- *Conceptualization (January – March 2009)*
  This project phase was conducted in Tallinn, inside the ITK. The author of this document proceeded to direct observation within the ITK environment, and used tools such as questionnaires and interviews to understand the institution and its agents as well. Data was gathered and analysed, and the conclusions were used to create an overview of the institution's characteristics and specificities.
  This phase was also used to attempt to gather additional developers for the subsequent phase through physical meetings with the goal of attracting students' attention to the project and virtual worlds as a whole. Communication with other institutions, which could constitute possible collaboration projects, was also conducted.

- *Development and testing (March 2009 – June 2009)*

The knowledge, gathered data and its conclusions from previous phases were used to create a presence in Second Life or OpenSim. Implementation plans were developed, design concepts were presented and there was a discussion of which tools and spaces to implement. The created team proceeded to the actual creation of these elements, testing them and modifying them in a constant and ever-changing process. Eventually, as elements were created, informal testing ensued. This process was strictly connected to the conceptualization phase, and the methodology ensured that a need to reformulate the tools or spaces would always be covered through a constant conceptualization-development cycle.

- *Conclusion (June 2009 – November 2009)*
  The findings of the research were inserted into the present document, and the author of the document returned to the home institution. The project will have following within the institution itself, and a number of conclusions and suggestions were created. The research team also reflected upon the problems felt during the process.

3.5. Methodological choices

The choice regarding the methodology in this project was of a hybrid nature. Instead of using a single methodological approach, it was decided that it should be composed of different methodologies of different natures, in order to fit equally different purposes. Therefore, both the social (or sociological) part of the research and its practical implementation will fit in these different methodologies.

For the research process, the dominant methodology is Action Research. The justification for this fact lies in the conduction of the research in a communitarian environment, where the ever-changing dynamics of the elements involved in the research requires elevated flexibility and adaptability.

Action research was first defined as a methodological approach by MIT teacher Kurt Lewin, upon the conduction of sociological research within very specific conditions (Lewin, 1946). Lewin defended that, in order to conduct meaningful research, it would be needed to comprehend not only “general laws of group life” but also the specificities of a

given context or situation, “the diagnosis of a specific situation” (Lewin, 1946). It’s on the situation’s specificities that action research is applied, not only as a diagnostic method, but also as a comparative method of which techniques to apply in the case at hand, in order to lead to active steps that create change within the social context.

This type of research presents a self-reflective nature: a number of steps are conducted in the research, “each of which is composed of a circle of planning, action and fact-finding about the result of the action” (Lewin, 1946). Therefore, there is a cycle of in which the researcher, based on previous knowledge, applies a certain change, evaluates its effects and repeats the whole process based on the new knowledge scheme. A spiral model has been created, condensing the process into three basic phases: “Look”, “Think” and “Act” (Stringer, 1999).

This type of research is especially suited to the research at hand due to its suitability to assist community-based problems and offering solutions, making use of a democratic attitude where all collaborations are valid and equal (Stringer, 1999). At the same time, it is important that the interaction between researcher and participants is conducted in a natural manner (Ferrance, 2000), which is also the case.

Therefore, in practical terms, the researcher was integrated in the IT College community, “looking” at the needs of the community regarding the implementation of a virtual world environment to support educational activities, and “thinks” about adequate solutions to the problem, having into account the reality of what he observed. Upon this reflection, he defines a plan and acts upon it, and this action is questioned and redefined through the same process a number of times afterwards.

This methodology was indeed the chosen one regarding the research process, but it was combined with Research and Development in order to obtain actual results during the implementation phase. Research and development is especially common under industrial contexts, but its nature is also suitable for educational initiatives.

The three main research types conducted under the methodology of Research and Development are basic research, applied research and experimental development. In this particular research project, and considering that research and development is employed especially in the implementation phase, experimental development is the primary method: it consists of “(…) systematic work, drawing on existing knowledge gained from research and/or practical experience, that is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.” (OECD Factbook, 2008). In this case, the knowledge gathered continuously through Action Research is applied in the creation

of a solution with Research and development methods. These two methods offer a strong interconnection, ideal for the conduction of the research at hand, which justifies its hybrid nature.

It is important to note that, while it is true that there are two different methodologies chosen, one does not end where the other begins. Both types of methods only make sense if the attitude of the researchers is that of continuous questioning and redefinition of knowledge and solutions. This attitude allows a never-finished environment that can adapt to the environment and new realities, something that can be defined as 'permanent beta version'. An approach of this sort may also ease the follow-up of the project after the end of the research itself, even if new researchers replace the initial ones.

3.6. Target audience

The target audience for this specific project can be subdivided in two different types. The first one is the primary audience and comprehends the active members of the IT College institution, specifically teachers, administration, staff and students. This is especially important because the tools, spaces or strategies developed inside the chosen platform(s) will have to be considered and developed to fit the needs and wishes of this main target audience.

The second type of target audience is much more broadening, as it includes virtually any external agent with interest in educational uses of virtual worlds (especially concerning the Estonian reality), IT College's prospect students, other educational institutions members or just regular OpenSim users, in the eventual connection of IT College's islands to an OpenSim public grid. This second type of target, albeit less direct than the first one, is of very relevant importance considering the creation of community dynamics associated to the project, which is one of its main objectives.

3.7. Data collection techniques and tools

In order to collect relevant information to the research it was necessary to choose/develop and use a set of techniques and data collection tools, each one would provide us data of different nature or quantity. It is upon this data that the decisions concerning the conceptualization and implementation of the project were made. The choice of one or a number of techniques was influenced by a number of factors, especially considering the features regarding the research environment (cultural

differences and language, for example), as well as the ones regarding the platforms of communication (such as Second Life/OpenSim's internal communication tools).

3.7.1. Pre-available bibliographic information analysis

Prior to obtaining new information through diverse tools and methods, it was also necessary to collect information already available, primarily of bibliographic nature. This consultation of information was made for all three main vectors of the research: Higher Education in Estonia, The Bologna Process and Virtual Worlds.

Most of the information gathered during this process was used during the pre-conceptualization phase. Only creating a strong background of knowledge about the elements related to and composing the project was it possible to conceive a research plan that would ultimately lead to implementation.

3.7.2. In-world meetings[4]

The use of the chosen platform (Second Life/OpenSim) as a communication tool presented itself as an obvious choice from the first moment. Besides presenting itself as an interesting platform for communication between the two geographical main points of the research (Aveiro and Tallinn) and the intervenients from both sides, it was also an ideal situation for some of the agents involved to get to know virtual worlds from the inside, getting familiarized with the tools offered and the possible means of interaction and content creation inside SL/OpenSim. The meetings inside Second Life had primarily the purpose of planning the research, understanding the specificities of the target audience and the main goals that the IT College intended to achieve with the research.

One of the main advantages of conducting in-world meetings is the ease offered in keeping records of the meeting. The Second Life client registers the public chat in which the user was involved, and therefore the archiving and posterior analysis of its content is quite straightforward. In this case, the registries were saved in shared documents published using Google Documents, available for consultation. These registries present the collaborations of each participant, identifying them with their avatar name.

The analysis of these registries is one of qualitative nature. It is impossible to quantify the information obtained using this method, but it is still of very important nature to the

[4] Presented in annexes 1 to 7

comprehension of the project development, especially regarding the phase of conceptualization and planning.

3.7.3. Surveys/Questionnaires[5]

One of the tools chosen to collect information during the conceptualization phase was the administration of electronic questionnaires. The choice for this kind of data collection tool is justified by two main reasons: the possibility to treat data statistically and the physical restrictions imposed in the first phase of the research, when the conduction of in-place interviews or meetings was impossible due to the distance between Aveiro and Tallinn.

The type of questionnaire created presented different types of questions, according to the type of information necessary – some questions were presented as open, giving the public an opportunity to state broader opinions or explain different expectations, whereas others were of a closed nature, meaning only a few number of options were presented. This type of question is more focused, in the sense that it demands a specific answer, which was considered to be necessarily pre-formatted beforehand.

3.7.4. Physical Meetings

The conduction of physical meetings was the main technique used during the second phase of the conceptualization process and especially during the implementation period. These gatherings were done only after the placing of the researcher in Tallinn, inside the IT College environment, therefore enabling a different sort of research tools and strategies, as well as a more direct contact with the target audience of the project.

The meetings included different people, both internal and external to the institution. During the conduction of the meetings the contributions from each element were all considered as valid, and the ideas and conclusions of the reunion were written down for posterior qualitative analysis.

3.7.5. SWOT Analysis

The SWOT analysis is a technique used both in business and organizations, which has as a main purpose the comprehension of a given situation or idea, in order to

[5] Presented in annex 8

support a decision making process about it. SWOT is an acronym, standing for "Strengths, Weaknesses, Opportunities, Threats".

It works exactly by pointing out the different characteristics of a certain project, idea or strategy, in a logical fashion. The following illustration is an illustration of the SWOT analysis process[6]:

Image 1- SWOT Analysis Model schematics

Strengths and Weaknesses are of an internal nature, meaning they are related to the project in its nature, whereas Opportunities and Threats are of an external nature, concerning the environment where the project unfolds, the competition or eventual partners.

This model of analysis was created and developed during the 1960's and 1970's with the purpose of helping major corporations (the Fortune 500) understand the reasons for corporate planning failure; with funding from these companies, the Stanford Research Institute, especially Albert S. Humphrey, worked on the creation of a model that could effectively help organizational planning (Humphrey, 2004).

By effectively defining these aspects related to a project, it is then possible to plan how to build on the Strengths, how to correct or remedy the Weaknesses, how to use the Opportunities presented, and how to fight the Threats discovered.

During this project, the SWOT analytical model was used during the conceptualization phase, and helped defining a conductive line of research. The results

[6] http://www.revolutionarydesignsolutions.com/ebnfindlay/images/320px-SWOT_en.svg.png

from other techniques and tools were also used to create and modify the results of SWOT analysis during the project.

3.8. Methodological model scheme

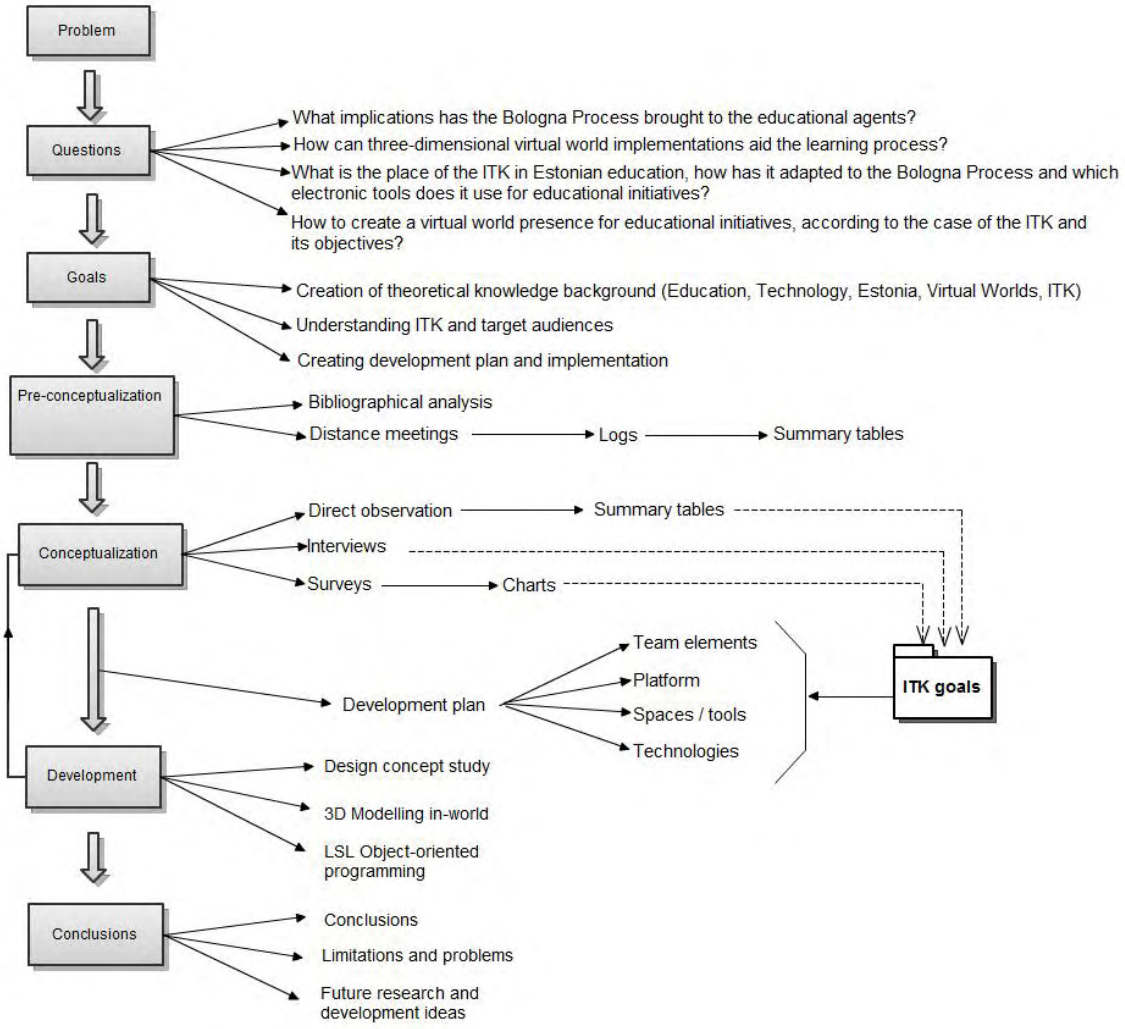

Chart 3 - Research Project structure

4. COLLECTED DATA ANALYSIS AND CONCEPTUALIZATION

4.1. Introduction

The collection data process, using the strategies and tools described in the previous chapter, affects directly the conceptualization phase – the actual development of strategies of implementation having into account the needs and desires of the target audience. Moreover, in the current research, the choice of an Action Research typology strengthens the connection between these phases and the actual development period.

The result of these facts is a constant process of data gathering, conceptualization or re-conceptualization, and new development based on the new data and strategy. Even so, it is important to note some possible bounded phases during the research, especially because they are inevitably obvious when considering that the researcher was geographically separated from the rest of the research team during one half of it, and inside that physical environment only during the other half.

Therefore, this chapter will present itself in a chronological order, detailing these phases, how the research was conducted in each one of them and their contribution for the final development.

4.2. Pre-conceptualization phase data – meetings within SL/Skype

The meetings described in this section took place from October 2008 to December 2008. This was a research phase that was characterized by the separation of the two halves of the research team, whereas the theoretical part of this project was being developed in Aveiro, Portugal, the target audience (*i.e.* the IT Kolledž) part was in Tallinn, Estonia. Therefore, the conduction of meetings and data gathering techniques were done at a distance, using electronic communication platforms.

Each distance meeting's contents are explained on the following pages, as tables containing the main points of each meeting.

Skype meeting, October 8th 2008[7]

Needs	Creation of Estonian-side coordination team. Student involvement especially during the development phase. Technical and social/pedagogical balance (due to the different approaches of home and host institutions). Focus of bibliographic research at this phase on the usage of SL as Higher Education tool
Possibilities	Collaboration with members of the Estonian Virtual Embassy in Second Life.
Goals	Supporting teaching activities of the college; Promotional tool for ITK; Possibility of conducting activities related to psychology or online behavior, with co-operations with other institutions; Distance learning tool.
Specificities	ITK is a very technical institution. Little experience among ITK staff in virtual worlds.

Second Life meeting, October 14th 2008[8]

This meeting took place for the first time inside Second Life. Since the environment presented the adequate communication tools, it was decided it was also necessary to get the members of the research to become more at ease with the use and navigation in the chosen platform.

In fact, the lack of experience in the usage of Virtual Worlds presented itself as an obstacle, and there was the need to explain the working of Second Life in particular to a part of the research team.

[7] In Annex 1
[8] In Annex 2

In order to present an idea of educational usage of Second Life, the group of intervenients took a virtual tour through SecondUA island, the Universidade de Aveiro official island (Oliveira *et al.*, 2007).

Needs	Second Life implementations should be considered 'permanent Beta'
Possibilities	Creation of a *sandbox* inside ITK island to promote community creation, collaboration and content creation. Focus of posterior research in accessibility issues. ITK can create new inter-institutional co-operations through an SL presence (as exemplified by U.Aveiro's presence in SL)
Goals	Orienting the implementation both to external audiences and to ITK's students
Specificities	Second Life has a number of limitations and technical specifications; Problems of SL with accessibility issues must be taken into account.

Second Life meeting, October 21st 2008[9]

Needs	Necessity of deciding the definitive core subject of research. Further emphasis on combining technical side of ITK and background in social web and virtual worlds of U. Aveiro.
Possibilities	Language learning activities suited especially for virtual world presences
Goals	Research intends to understand how to use virtual worlds to support educational processes.

[9] In Annex 3

	New needs of education (Bologna Process) to be addressed.
Specificities	Definition of 3 main vectors of research: Education (Bologna Process), Estonia (ITK), Technology (virtual worlds)

Second Life meeting, October 28th 2008[10]

Needs	Understand target audiences, especially students of ITK: - Background - Technological Tools used - Educational strategy Need to create development team addressed once more.
Possibilities	ITK allows the use of varied technological tools for educational purposes as long as they are free and of open source nature. 'Web 2.0' tools were becoming more common inside ITK. Creation of co-operations with Vaasa University of Applied Sciences (partner institution that already has SL presence)
Goals	-
Specificities	-

Second Life meeting, November 25th 2008[11]

Needs	Critical issue of research project team addressed, regarding conceptualization and development phases.
Possibilities	-
Goals	Introductory event arranged for December 16th 2008 – presentation of the platform and project to students, with the goal of finding interested parties to integrate team

[10] In Annex 4
[11] In Annex 5

Specificities	-

Second Life meeting, December 9th 2008[12]

Needs	Synchronization of research status between teams. Arrangements for introductory even to students.
Possibilities	ITK has a strong and active robotics department, possibility of creating extension inside virtual world implementation.
Goals	-
Specificities	-

Second Life meeting, December 16th 2008[13]

As the initial phase of the research moved forward, it was necessary to attract ITK students for the development phase of the project, specifically for tasks connected with 3D modeling, programming and designing of spaces and objects inside Second Life.

With this in mind, the meeting held on December 16th 2008 was broadcasted in the main auditorium of the ITK building, and the ITK team tried to assemble a group of interested students to attend. A total of 16 students were present, and the Portuguese side of the team proceeded to present the Universidade de Aveiro's presence inside Second Life, SecondUA, in order to showcase some of the possibilities of development inside SL. It was explained that each of the buildings and tools created in SecondUA intend to serve a predefined purpose.

During the tour, when in one of the in-world classrooms of SecondUA, there was the display of a presentation, explaining in detail how the research project was structured and planned, the needed profile of the collaborators and the skills necessary.

[12] In Annex 6
[13] In Annex 7

4.3. Pre-conceptualization phase analysis

After the round of meetings between the members of the research project team, and acting accordingly to the research methodology, it was necessary to summarize the conclusions and agreements reached during this initial phase. As detailed in the methodology section of this document, the technique used for this end is the SWOT analysis.

ITK project SWOT Analysis

Strong technological background of the institution. Openness to the use of new tools. Large variety of possibilities to implement. Willingness to incorporate external public (*e.g.* sandbox). **strenghts**	Target audience's and team inexperience in virtual worlds. Lack of integration of the project with curricula. Non-existance of a support and development team. Communication between both parts of research (Portugal and Estonia) limited at this phase. Lack of exact goals for short-term implementation. Technical profile of the institution might create lacking in some areas. **weaknesses**
Pre-existent collaborations with institutions already in Virtual Worlds can extend in-world. Creation of new collaborations due to a presence in-world. Estonian embassy already created in SL, connections existent. Robotics department may be interested in having an in-world extension. **opportunities**	Fear to attract of the wrong kind of public to the space. Accessibility problems related to virtual worlds. Cost associated with SL presence. **threats**

Strengths

The initial phase of meetings and research was enough to disclose a number of strong points associated with the project. Firstly, the research environment, a very technical and technological institution, ensures that the students – a primary target audience – are tech-savvy. This factor is very important especially regarding the learning curve required by virtual worlds in general, and Second Life in particular. The 'gaming'

characteristics that a virtual world normally possesses can present difficulties to an average user, but the experience in this kind of environment may ensure ease in the adaptation to the platform.

Another potentially strong point is the ITK's willingness to incorporate new electronic tools in the education process. The attitude of the staff of the institution is that of supporting the use of any tools that can be beneficial to the learning process, as long as they don't conflict with the budget of the institution. Therefore, the introduction of a virtual world environment should not be met with any resistance related to habit of use of other platforms, but as a complement to the ones already used.

One other point (which can also be turned into a weakness, as analyzed further in this document) is the large variety of possibilities to develop and implement. The inexperience of ITK in virtual world activities means that it is therefore possible to propose interesting and varied projects to the institution, and they will be a starting point in which to build in the future.

A final strength to point out is an additional open attitude, this time towards the audiences to which the project is aimed. According to the ITK team, the project is targeted not only to the internal crowd of the institution (meaning students, teachers and staff), but also to the general user-base of virtual worlds. This attitude may be a strong factor in the creation of an active community around the virtual world space.

Weaknesses

Opposite to the strengths of the research project are its identified weaknesses. At this point, after the introductory meetings, a number of problems were already identified.

Perhaps the most flagrant weakness of the project is the inexperience of the Estonian members of the team concerning virtual worlds' usage and development. At the beginning of the research none of the members had used Second Life for educational purposes or even random use. The need to gain experience was in part minimized via the conduction of the research team meetings inside Second Life, creating the conditions for the team members to learn how Second Life works and how content can be created *in-world*. Nonetheless, the learning curve will inevitably collide with the conceptualization and development phase, reducing the creation of actual results.

One of the major weaknesses of the research project was the lack of its integration in ITK's student curricula. This fact reduced the number of possible students involved in the project, and adding to the fact that the prototypical student of ITK has skills that are perhaps too technical for a project of this nature, seriously compromises the creation of a

strong development team that can address the several challenges concerning design and implementation of a space and its tools inside Second Life. Ideally, the research project would be suited with a development team from the first phases of conceptualization onwards, but that was not the case in this research project, and it would be necessary to search for students to compose this team in a posterior phase.

An additional weakness concerning the communication flow between both sides of the research project team (Tallinn and Aveiro) can be indicated. The geographical distance between both points reduced communication to electronic tools, such as IM, e-mail and chat, and the conduction of physical meetings was impossible until January 2009. It was therefore complicated to maintain a constant exchange of information, and data gathering tools were quite limited as well. In addition, the cultural differences between members of both teams were also a condition to consider, and were hard to overcome on a distanced basis.

Finally, regarding the research project's goals, the indecision around the actual results desired by ITK and its team could be viewed as critical at this phase. The inexperience, as already pointed out, presented by ITK in the use of virtual world platforms resulted in the difficulty to consistently and objectively define the goals of the research project. As a result, it could be extremely complicated to subdivide those goals into plausible and short-term implementations.

Opportunities

A number of opportunities presented at this phase of the research project. These were mainly the result of the analysis of the meetings held in Second Life with the Estonian team members, particularly concerning information related to the ITK and its environment, status and partnerships.

One of the opportunities that was soon pointed out as interesting was the creation of collaborations with other educational institutions. As a matter of fact, the IT Kolledž had already, in the beginning of the research project, collaboration initiatives with several other institutions, and the opportunity was reinforced by the fact that a number of them had already conducted experiences inside Second Life, or even possessed a presence *in-world*. It was therefore interesting to extend these partnerships to a second dimension, inside a virtual world platform.

At the same time, new collaborations could be created by having a space *in-world*. The IT Kolledž is a technical institution, but the creation of collaborations with institutions of different natures and aims would be a possibility once the presence of ITK was online,

or during its implementation phase. Considering that a virtual world platform can be accessed from a multitude of geographical spaces, the use of an ITK-hosted space by a number of partner institutions could constitute an interesting initiative, even regarding expense sharing additionally to educational potentialities.

One interesting fact could also lead to the creation of additional partnerships – the Estonian government already possesses a presence in Second Life, the Estonian Embassy. One of the main developers of the space was a regular presence in the meetings of the research team. Therefore, the linking of the ITK project with the Estonian Embassy would be an interesting prospect.

On a different dimension, the ITK itself has specific activities that could profit from an extension into a virtual world. One main example presented by the Estonian team was the ITK robotics club, quite reputed nationwide, which could perhaps conduct simulation activities in Second Life.

Threats

The research project at hand presented some additional problems concerning external factors, threats that can offer additional difficulties to the research project.

A concern soon manifested by the ITK was the attraction of a wrong type of audience to an open island. Even though Second Life offers a number of mechanisms to minimize this type of problem, it is indeed a valid concern that has to be taken into account in the choices made during the design and implementation phases.

An additional problem relates to accessibility issues regarding virtual worlds. This problem is intrinsic to virtual world platforms, and has to be taken into account. Nonetheless, most of the problems concerning this factor are external to the research project at hand, residing more in the platform itself, and may not be easily solved or minimized.

One major external threat to the entire research project was the economic reality felt at this phase. Economic concerns were felt throughout all types of institutions, including Higher Education ones. An implementation in Second Life has a number of associated costs to be considered, and this fact can present a major difficulty in subsequent phases.

4.4. Conceptualization phase data

The conceptualization of the project, on its most evident phase, started in January and February 2009. At this point, the author of this document moved to Tallinn, Estonia

for a period of six months to design and implement solutions for the IT Kolledž, based on the information gathered so far related to the institution and its environment and audiences.

This way, it was now possible to conduct face-to-face meetings, and improve the communication between the research project team members.

4.4.1. Start-up meeting

The first face-to-face meeting held in IT Kolledž on February 3rd 2009 had the main purposes of getting the team members to know each other, synchronize goals and possibilities for the project, and above all get the students to be involved and participate in the project.

Start-up meeting description

Needs	Creation of a support wiki (to be created immediately) in Estonian language
Possibilities	Idea about ITK collaborating closely with Estonian Foreign Ministry to look over Estonian Embassy in SL. Creation of collaborations with possible institutions: • Tallinn University • Tallinn Pedagogical College • Tallinn University of Technology • Tartu University • Erasmus Student Network (ESN) Tallinn • Archimedes Foundation's Centre for Educational Programmes OpenSim as a serious alternative to Second Life: • Can be stable if set-up properly • Mature phase of development • Freedom of configuration and set-up • Free cost of installation • Some technical limitations, some features not implemented yet or limited Extension of project to other institutions and its integration in curricula could interest a larger number of students in the project.

Goals	Create 2 dimensions in an ITK SL island: • administrative (promotion) and formally academic; • informal side, towards community and informality
Problems	Lack of student interest (only 3 students were present, and didn't show interest about integrating the project team). Previous Estonian institutions (such as Estonian Embassy) in SL experienced low level of public interest, and lacked a capable and active coordination team.

4.4.2. Primary target audience questionnaire[14]

In order to better understand the primary target audience towards whom the project was being developed a questionnaire was distributed. Considering the technical profile of the ITK students, it was decided that the questionnaire would be created and distributed using an online platform (in this case the tool chosen was Google Docs Live Forms). The hyperlink to the questionnaire was then sent to a large number of students of ITK, and as they responded to the questions it was possible to analyze data in a dynamic way, using tables and graphics.

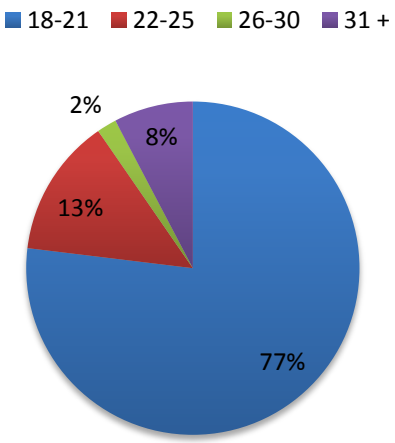

Chart 4 - Target audience age

[14] Available in Annex 8 and in http://spreadsheets.google.com/viewform?hl=en&formkey=dFlBVFhKLVpEZEtON0ZJUnlLV1FCMGc6MA

The sample audience of people who answered to the questionnaire was mostly on the age interval of 18 to 21 years old, more specifically 77% of the students.

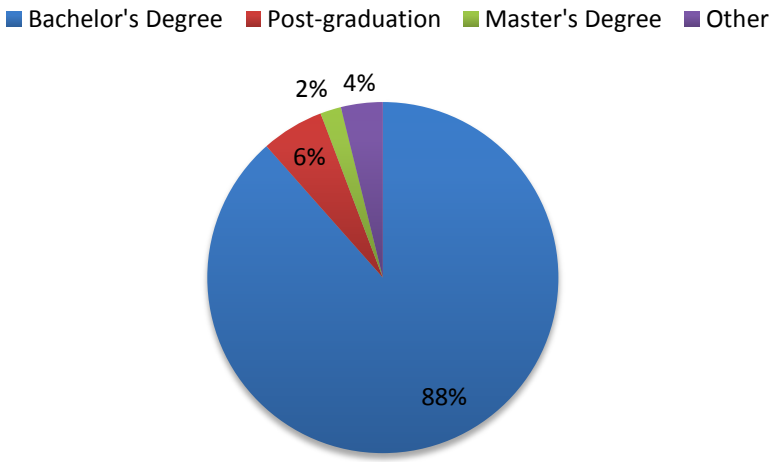

Chart 5 - Target audience current academic frequency

The sample population was mostly under the ITK curriculum for the Bachelor's degree. From a total of 52 inquired students, 46 were in this condition.

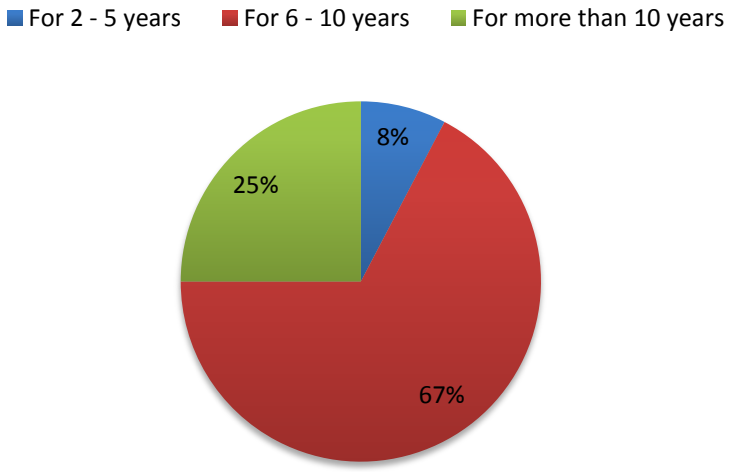

Chart 6 - Internet and online content usage experience

The answers to this question present the experience in the usage of the Internet in general. The large majority of inquired students has been using online contents for a

large number of years, in this case for over 6 years. 25% of the inquired population has inclusively been accessing online contents for more than a decade.

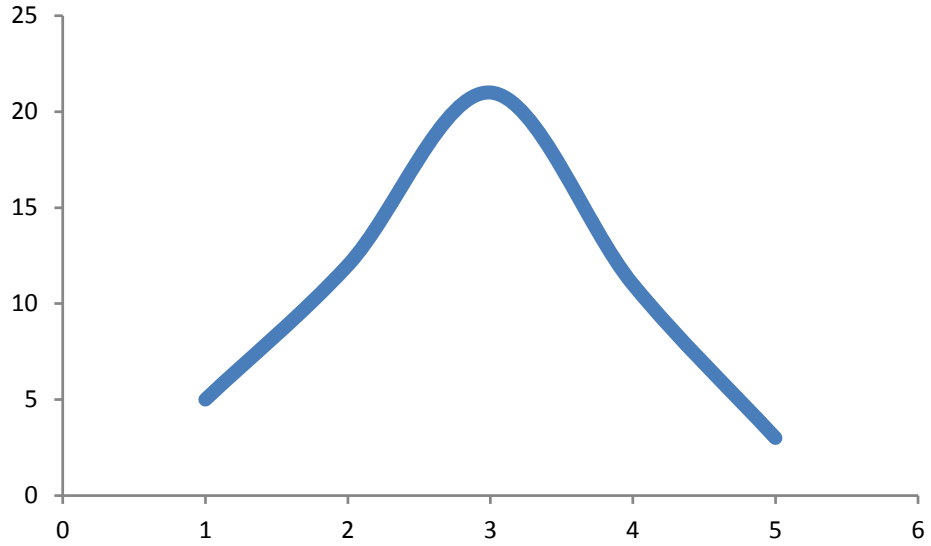

Chart 7 - Ability to self-manage time

In this question inquired students were asked to self-evaluate their ability to manage time. The above chart uses 1 as the minimum ability to self-manage time, and 5 as the maximum. In the obtained results students pointed mostly towards considering their ability as average (40%). Only a minority of the inquired population considered their ability to self-manage time as very bad (10%) or very good (6%).

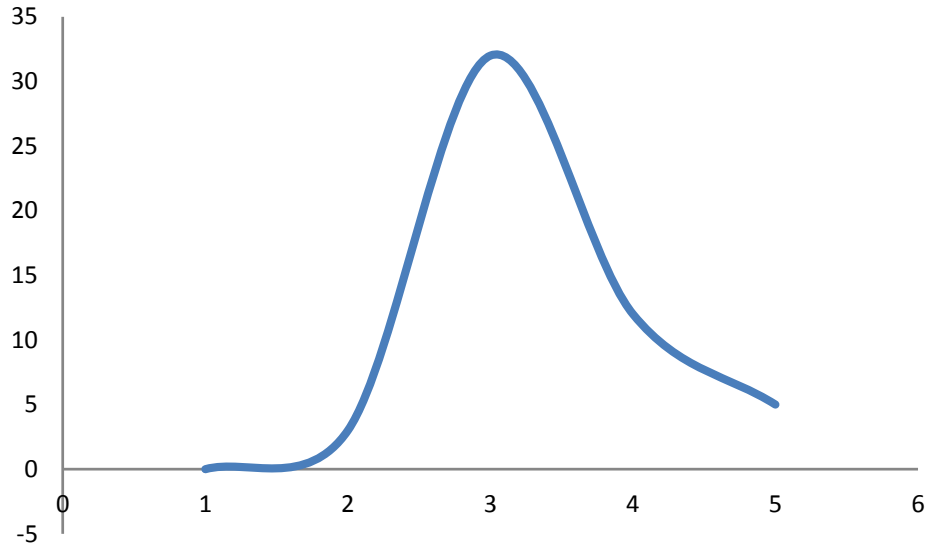

Chart 8 - Student autonomy under ITK activities

With this particular question it was intended to understand the type of activities the students take part in under ITK curricular activities. In the above chart, the value 1 corresponds to very low level of autonomy (supervisioned work) and value 5 to high level of autonomy (completely autonomous work). Answers point mostly to a balance between supervisioned and autonomous work, with a slight tendency towards autonomous activities.

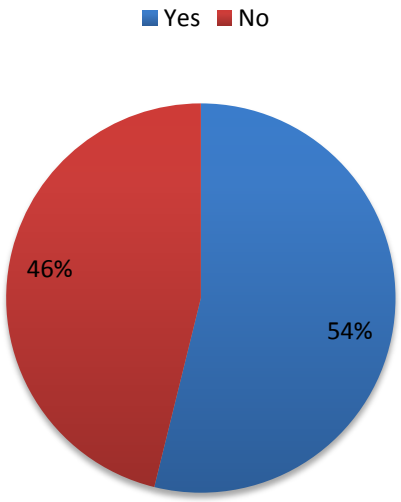

Chart 9 - Perspective of studying abroad on short-term

The inquired population was asked about considering studying abroad in the near future. 28 answered positively, and 24 negatively.

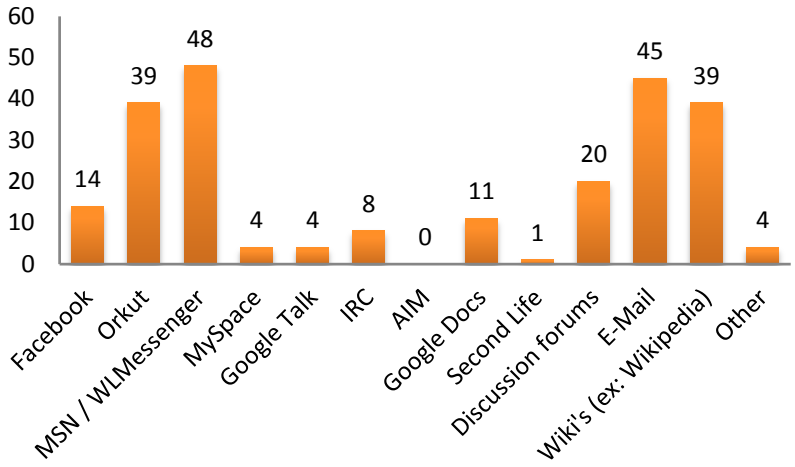

Chart 10 - Online services used

The results obtained in this question relate to the online social platforms typically used by ITK students on an everyday basis, for both formal and informal communication events. As represented above, the most common services among ITK students are social networking platform Orkut (used by 39 out of 52 students), IM platform MSN / Windows Live Messenger (used by 48 out of 52 students), E-mail services (used by 45 out of 52 students) and collaborative knowledge Wiki resources (used by 39 out of 52 students). Virtual world platform Second Life was only indicated as being regularly used by one of the students.

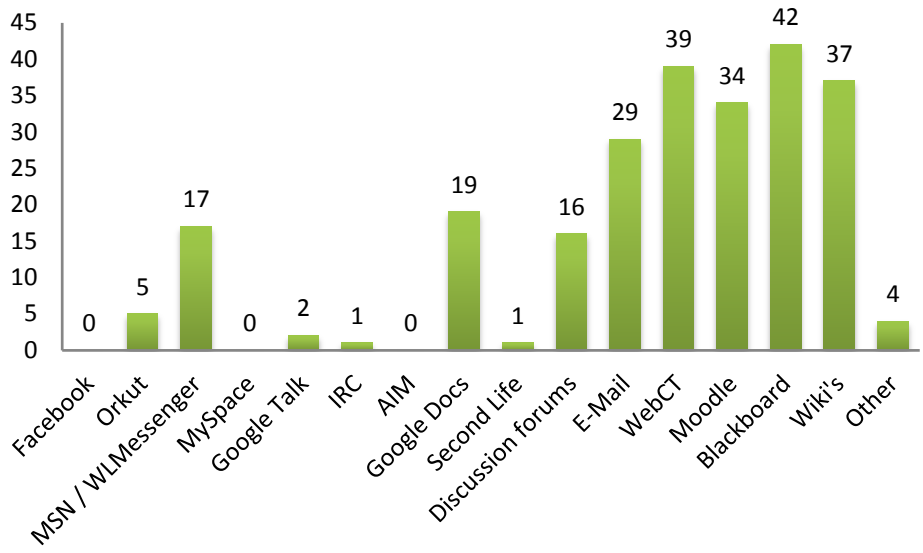

Chart 11 - Online services used for ITK educational purposes

Similarly to the previous question, this question also presented multiple options of online services and platforms, but in this case the nature of their usage was restricted to educational activities under ITK curricula.

A number of additional platforms were added considering the more typical e-learning platforms such as LMS systems. The results showed a high number of users of these systems: WebCT was used by 39, Moodle by 34 and Blackboard by 42 students, out of a total sample audience of 52 students. Wiki software was also indicated as being commonly used in educational situations (37 students out of 52), as well as e-mail (29 students out of 52).

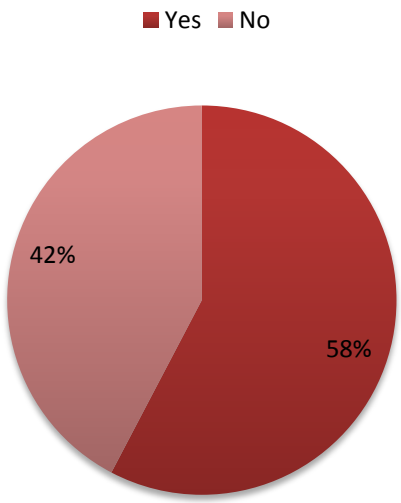

Chart 12 - Experience in virtual worlds platform

Students were answered if they ever used virtual world platforms. A total of 30 students answered affirmatively, whereas 22 students had never accessed virtual worlds.

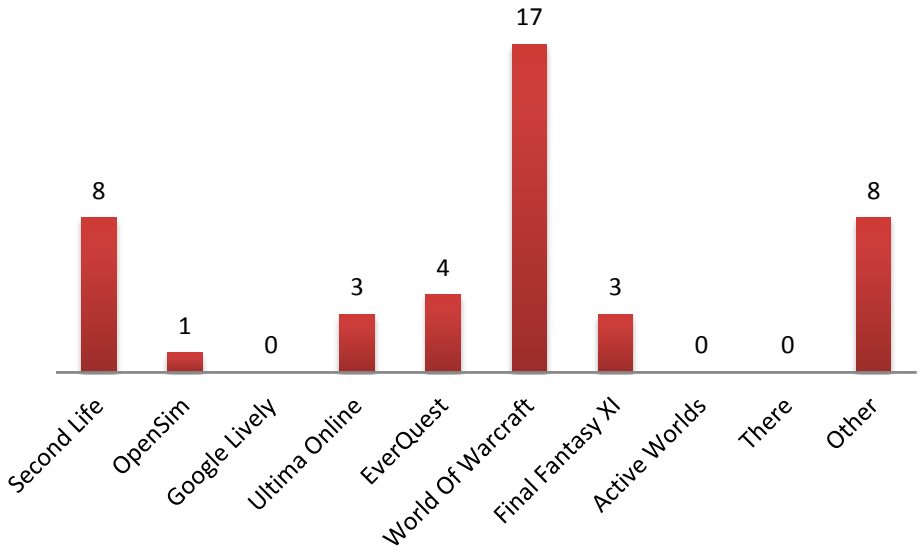

Chart 13 - Virtual world platforms used

This question was dependent on the affirmative answer in the previous one. It was asked to students that had previously used virtual world software to indicate which platforms they had used.

From a total of 31 affirmative answers, 17 had used World of Warcraft, corresponding to 61% of virtual world users. 29% had used Second Life, and another 29% indicated

additional virtual world platforms they use or had used in the past, composed entirely of MMORPG's such as MU Online, Aion, Warhammer Online, Anarchy Online, Diablo 2, Project Entropia and EVE Online.

Students were then questioned about their expectations regarding an ITK virtual world implementation, especially concerning its advantages for a different number of purposes.

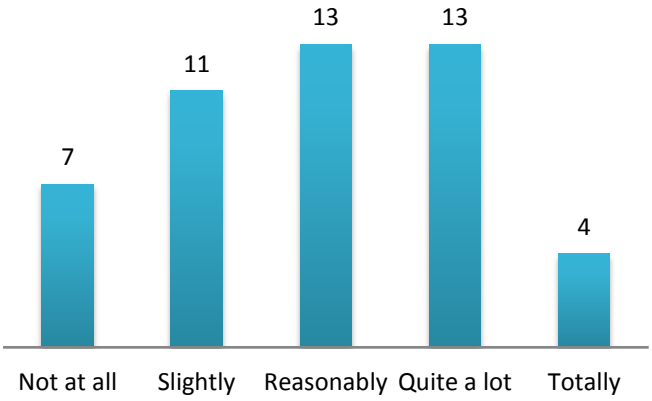

Chart 14 - Expected interest in in-world informal communication situations with other students

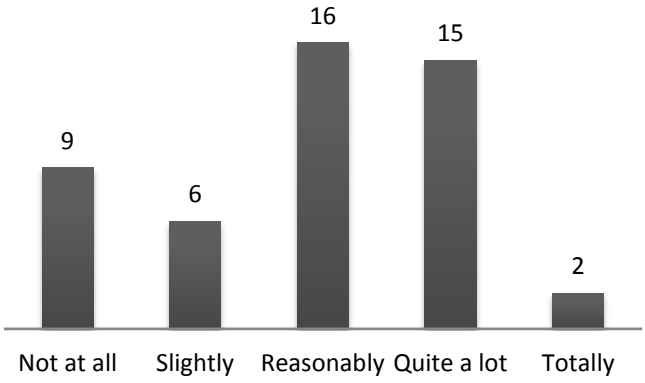

Chart 15 - Expected interest in in-world informal communication situations with teachers

Chart 16 - Expected interest in participating in in-world formal classes

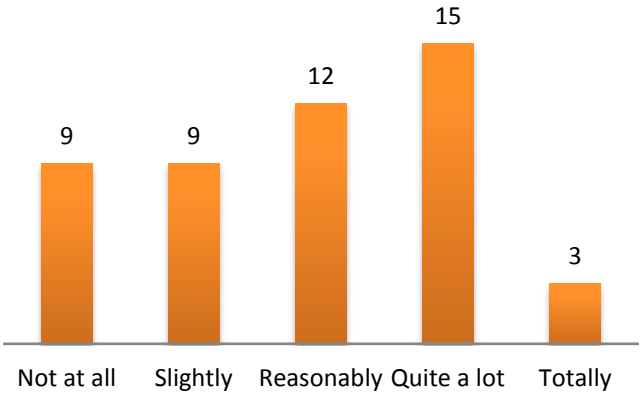

Chart 17 - Expected interest in conducting scientific experimentation (e.g. physics simulations) in-world

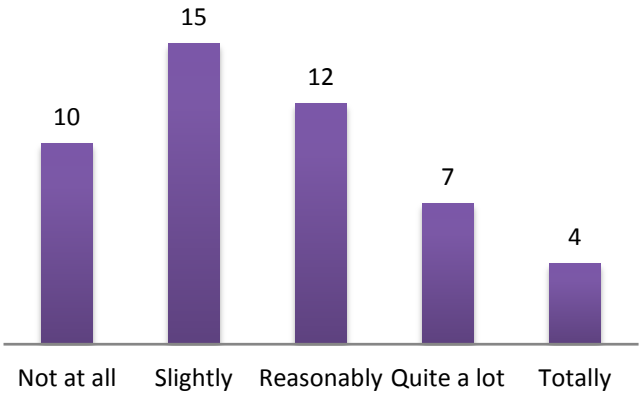

Chart 18 - Expected interest in accessing hosted academic content (text, images, video...) in-world

A note to the number of answers to this round of questions: 4 of the inquired students opted not to answer to these questions, and therefore the total of answers amounts here to 48.

This group of questions related to the different usages of an ITK virtual world implementation diverge in their answers. Relating to informal communication with other students, a majority (63%) considered that it would present at least a reasonable amount of interest. A larger number considered at least reasonably interesting the prospect of conducting informal meetings with teachers (69%). The same case applies to the scientific experimentation *in-world*. In the cases of participation in formal classes conducted *in-world*, as well as accessing hosted contents, the balance of answers tends to point to a lower degree of interest: 48% of students considered that formal classes *in-world* would be have at most a slight interest, and an even higher percentage (52%) considered the access to hosted contents as a prospect of less than reasonable interest.

4.4.3. Interview/questionnaire with ITK rector

A questionnaire was conducted with the IT Kolledž rector, composed mostly by open questions; the main objective of this exercise was to understand the expectations and ideas of the ITK administration concerning the project and its future. Data gathered from this exercise will be compared with the data reports from the students' questionnaire to create an analysis of the whole ITK environment.

> ***What kind of institution is the IT College, concerning its status (private / public / other) and nature (technical / academic / other)? Elaborate on your answer if you deem it necessary.***
>
> *"By definition, Estonian IT College (EITC) is private but non-profit higher education institution, owned by Estonian Information Technology Foundation (EITF), established by two largest Universities in Estonia (Tartu University, Tallinn University of Technology), by Estonian Telecom, Association of Information Technology and Telecommunications, Estonian Ministry of Educational and Research. The education in EITC is application oriented, all curricula are belong to Computer Science study line/direction. Curricula are fully (internationally) accredited."*
>
> ***How does the IT College integrate (or not) the Bologna Process? Which guidelines and main values of the Bologna Process are the most important for the IT College and its staff and students?***
>
> *"Education in EITC was and is set up following Bologna 3+2 higher education model. Currently, the college is focused only on first level of higher education (3-year curricula), cooperating tightly with founder universities (and not only) to*

guarantee fluent continuation of graduates at Master level. For now, all study programs and courses are defined on base of study outcomes, but process for better integration of study outcomes still continues."

What major difficulties were in the past, or are in the present, faced by the IT College concerning the enforcement of the Bologna Process?

"Since IT College was established in 2000, the 3+2 system was established since beginning. A lot of work and self-education demanded changing the study goals orientation from input to output (study outcomes). Also, the assessment will change on base of study outcomes but necessary changes in Higher education standard have not been set yet (estimated in next study year). Changing credit system from old credit points to ECTS took also few years to establish and smoothen. ECTS is used in Estonian HE institutions exceptionally since this fall (2009)."

Do you consider that the Bologna Process had a big impact on IT College's staff and students habits of working and communicating? If so, what reasons would you cite for it?

"The system, established at EITC was new since beginning and teachers, who had former diploma education experience had to adapt. Concerning students, it was not as difficult because EITC is covering only first level of HE, there was no legacy. Due to fact that remarkable set of teachers is visiting teachers (from other institutions, from industry) EITC had to spent resources (time, money) to educate visiting teachers. The benefit of such training has been better communication and mutual understanding of Bologna goals."

Which of these characteristics would you consider to be prototypical in an IT College student?

☒Autonomous work oriented
☐Collaborative work oriented
☒Able to self-manage time
☒User of social tools for study
☒Strong self-learner

Which tools are you aware to be used by IT College students and staff for study-related environments?

☒Social networking platforms (Facebook, Orkut, etc.)
☒Instant Messaging applications (WLM, AIM, Google Talk, etc.)
☒Collaborative working environments (Google Docs, etc.)
☐Virtual Worlds (Second Life, etc.)
☒Chat rooms and applications (IRC, etc.)
☒E-mail

Do you consider that students and staff in the institution face Virtual Worlds such as Second Life or OpenSim as an interesting platform for educational purposes? What reasons do you present for your answer?

"Students and staff are aware (especially in connection of Aveiro University and Erasmus student and teacher exchange) about Virtual Worlds (VW). A lot of collected information is available in dedicated wiki about Virtual Worlds. Still, there are not teachers, who feel confident (lack of training, experience) in usage of VW-s for education purposes although student initiatives will be supported. The general opinion is that such environments can be used more in the future but integration with study administration environments has to be solved too. Currently there is so rich set of fluent communication options that VW are not deserving special attention. Although some diploma works are dedication (some in work) on research of VW as study -environments, the breakthrough has not happen."

Which aspects does IT College face as important in a Virtual Worlds implementation?

☐Conduction of formal learning activities (classes, lectures)
☒Conduction of informal learning activities(meetings, games)
☐Communication among students and staff
☒Communication with distant or mobility students
☒Integration with curricula
☒Conduction of extra-curricular activities
☒Integration with external technologies and platforms
☒Open-source nature
☒Promotion of the IT College (prospect students…)
☒Creation of collaborations with other institutions
☒Simulation of environments or conditions (robotics, physics)

Please write any other aspects you would consider important to the research in hand.

"Using of virtual worlds is challenging - there is financial aspect, which was amplified due to recession and cancelled an idea to use SL features. OpenSim is demanding much more attention and effort to guarantee at least some stability. Also, learning curve is long and experience of using VWs for education is distributing slowly. Despite this, even these relatively modest results of IT College have been recognized and there are other HE institutions interested of our experience."

4.5. Conceptualization phase data analysis

The data gathered during this phase, conducted inside the IT Kolledž, helps to better understand the target audience towards whom the project is aimed. The focus of the data gathering tools was in the transversal competences required by the Bologna Process, the experience in the usage of online tools, especially social web tools, and the knowledge and history of experimentation in virtual worlds. At the same time, an attempt

to understand the expectations of students regarding virtual worlds' usage was made, presenting possible scenarios for the future and understanding how students face them.

The student audience of the ITK is mostly in the 18-21 years interval and is characterized by a strong experience in the usage of online content. This includes online and social Web tools like IM, social networking platforms and wikis in the majority of students.

Nevertheless, this sort of platforms appears to be used mostly on non-education related environments. ITK Students appear to prefer the usage of more typical learning support platforms such as LMS's for ITK-related learning goals, with the exception of wikis, which are used for both educational and non-educational purposes.

Students consider themselves as average when it comes to the ability to self-manage time, whereas they consider ITK activities as typically more autonomous than supervisioned.

The information provided by students does not entirely confirm the considerations of the ITK administration. The rector of the institution characterizes the ITK students as strong self-learners and able to self-manage time, and the activities they undertake in the ITK environment as mostly autonomous. At the same time, it is considered that the students use social tools for education purposes, which conflicts in part with the student-provided information.

It is also considered that collaboration activities are not typical for the ITK students, which is an important information relating to the nature of virtual worlds, strongly connected to social and collaborative principles, and may aid to explain the lack of interest of students observed in the start-up meeting of this phase.

One of the ideas discussed during the pre-conceptualization phase was the help a virtual world implementation would support to mobility students. The students were inquired about their interest in studying abroad in the near-future, with responses strongly pointing into a large crowd of mobility students. This may, therefore, present an interesting prospect for future implementation.

The experience in the use of virtual worlds among students is relevant; nonetheless, the platforms that students have experimented in the past are mostly MMORPG's. Only 29% of students have tried Second Life, and its regular use among the student community is extremely reduced (only one student indicated it as a regular tool).

However, the interest indicated by students in the future use of virtual worlds by the ITK is relevant, especially for scientific experimentation goals, as well as for informal communication with students and teachers. The conduction of classes and access to

academic content hosted *in-world* are purposes indicated as of less expected by the students.

The institution itself considered similar aims considering its students. Purposes such as informal learning activities, communication with mobility students, extra-curricular initiatives and scientific experimentation were goals the ITK pointed out as interesting. At the same time, it also considered ITK promotion and collaboration with other institutions as prospects in a virtual world implementation, and pointed out the open source nature of projects as an important factor.

Nonetheless, virtual worlds appeared *"...not* (to be) *deserving special attention..."* by ITK staff, mostly because teachers have little experience in MUVE's, and integration of these platforms with external technologies are expected by them. Still, student and institution acknowledged the possibility of integrating virtual world implementations, even if a Second Life implementation would be limited due to financial limitations.

Another important issue to indicate is the Bologna Process status of implementation in ITK. The institution has applied the education model enforced by the Bologna Process and has started to use its guidelines, but as a technical institution its influence has not been felt on such a degree as on general universities.

5. TECHNICAL IMPLEMENTATION

5.1. Abandoned concepts and technical choices background

According to the ideas discussed in this phase's first meeting, a first implementation idea was proposed to the team. Since there were two options for the implementation platform, Second Life and OpenSim, and there were advantages and disadvantages associated with each one, this plan worked under the premise of creating a dual presence: an OpenSim and a Second Life implementation.

Image 2 - ITK Downtown tentative logo

The Second Life side of the concept was branded 'ITK Downtown', because its main premise was that of being a public space, for the community, an open environment. Some concerns about this part of the implementation would evolve around the communication strategy, especially taking into account the ITK's concerns with the image of the institution inside a virtual world.

The creation of a communitarian attitude would be the focus in this area, especially in the sense that the island would need to have constant activity. In the same sense, this island would host most of the visible inter-institutional co-operations, allowing for more constant activity in the space. This space would obviously be suited for promotional activities, considering its main public availability.

Concerning design and implementation, this space would have to be preceded by design studies and conceptualization, because its appearance would be the face of ITK to the community. At the same time, the tools implemented in the space would be optimized before being placed *in-world*.

Image 3 - ITK Factory tentative logo

The other dimension of the project was branded 'ITK Factory'. This designation was used due to the intention of using this dimension of the project as a work-related environment. Its main characteristic would be an OpenSim implementation, and therefore installed *in-house*, in ITK servers, with more controlled status and access.

This space would be suited for free experimentation and research, especially having into account the risk would be much smaller when compared to an SL implementation. The freedom to create spaces and objects would be almost total, and it would constitute also an ideal testing ground for solutions to be applied in ITK Downtown afterwards.

This space would also be ideal for ITK's internal activities, such as programming lessons or courses, or the extension of the robotics department. This fact takes additional relevance considering some constraints imposed by Second Life, which are non-existent in OpenSim.

Additionally, ITK Factory could still be connected to external grids, through some of the public accessible OpenSim Grids, which would allow the connection with other institutions or initiatives.

However, shortly after this concept was presented, the research project team had to face a critical decision, due to limitations of financial nature. Due to the global feeble economical climate, the direction of the IT Kolledž was forced to cut expenses in certain projects. Such was the case with the research project described in this document.

In order to maintain the development of the project, it was therefore necessary to make decisions concerning the budget cut. This factor was the main cause for the final implementation platform choice. Since a Second Life presence has a number of associated costs, the research team opted out of Second Life for this particular project, focusing it instead on OpenSim. The open source and free nature of this platform presented it as a viable alternative to Second Life on a number of dimensions. At the same time, the previous existence of a plan for OpenSim implementation allowed for a quick re-adaptation of goals, even if a number of previously existent ones had to be put aside for indeterminate time.

The compromise made at the time concerned mainly the components concerning promotion of the ITK and its activities. Compared to OpenSim, Second Life presents a stronger social component due to its global status and public access, as well as more acknowledged status. An OpenSim implementation may arguably be more limited on that aspect, but it does present strong arguments related to the possibilities related to development and implementation. Therefore, the implementation was planned taking these factors into account.

5.2. Design concept

The development inside a virtual world appears to commonly reflect real-life spaces and objects, and in some cases architectonic styles, historical sites or fantastic worlds. Through a series of discussions and brainstorming acts with the coordination and development team it was decided that the concept behind the style of the ITK presence should be based in the typical Estonian countryside buildings and environment. A prime example of the intended style desired is exemplified by the Estonian Open-Air Museum (*Eesti Vabaõhumuuseum*), situated in Rocca-al-Mare, Tallinn[15].

Image 4 - Example of Estonian traditional rural architecture, Rocca-al-Mare (Tallinn)

[15] http://www.evm.ee/

The choice of this architectural style would impact the building process and its subphases, as the 3D modelling process in OpenSim is done recurring to blocks (called primitives, or prims) and it is necessary, before starting to actually create buildings and tools in-world, to deconstruct the objects and understand the best way to translate it into a number of 3D primitives. At the same time, in order to better give the desired appearance to the objects built, it is necessary to properly texturize the primitives. In this case, a number of primitives would have to be found that reproduced the wood used in most real-life buildings, for example.

The reproduction of these buildings and styles intends to translate the historical visual culture of Estonia. The forest, for example, is an inevitable element to include, considering 47% of Estonia's area is covered by forest. Another element chosen to build and incorporate in the space was a reference of a traditional Eastern-European folklore tale, the hut of "Baba Yaga", a sort of witch house standing on chicken legs. It was suggested by the ITK staff that a twist should be made on the original idea, with sports shoes being used instead of chicken legs.

Image 5 - Illustration depicting Baba Yaga hut legend

As for the number of islands to be implemented (considering that OpenSim offers the freedom to install a varied number of islands in the same server with no costs, contrary to Second Life), it was decided that three islands would be created for now. Each island would, however, serve different needs and purposes.

The first island would serve as a support for informal communication and community socialization. The concept of open spaces was planned, and a number of buildings

would be created and texturized to integrate the build style described previously, representing traditional buildings from Estonian countryside. A number of animations and behaviours would be programmed within the buildings and objects in order to allow the interaction of residents with them, and also to make them more realistic.

The second island intended to be a space for experimentation, without buildings *per se*, but only the original island landscape. It was intended that this island would be a first space for free building and programming for ITK students.

The third and last island would integrate the previously mentioned “Baba Yaga” inspired building, and would be a more closed space, with some tools for presenting slides or gather people to conduct formal or informal academic meetings. It was decided that the building would be built on a large scale, taking over almost the whole island space.

5.3. Implemented solutions and spaces

After the decision concerning the design concept of the islands to implement the development process began. Due to the technical and team limitations which will be explained in subsequent chapters the final implementations fell short of what was initially expected, especially concerning the development of technical interaction solutions.

It was still possible to develop the spaces planned for this phase, using the architectonic style chosen by the ITK team.

Image 6 - Default OpenSim islands

The development started with the installed islands on the OpenSim server, in a completely stock state. The topology of the islands was modified according to the

spaces and buildings which were planned in advance. For this effect the internal tools of the Second Life client software were used.

The creation of elements that provide the appearance of forest (as planned in the design phase) was then conducted in the islands, in order to provide a typically Estonian countryside environment look.

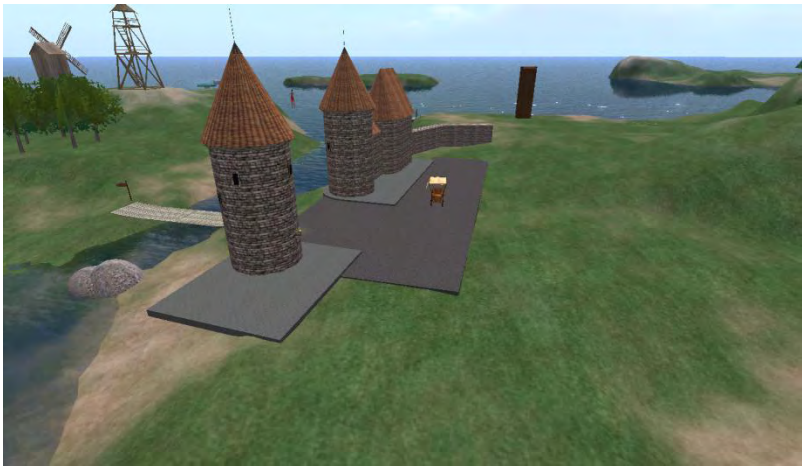

Image 7 - Replica of Old Tallinn Gates, in construction

One additional element to the planned buildings and spaces was the construction of a replica of the Old City Gates of Tallinn, or Viru Gates, and typical elements of this historical part of the city, such as the medieval-themed carts used by restaurants. This implementation, however, was incomplete by the end of the development phase of this particular research project. The goal of a space with this type of elements was that of promotion of Estonian typical visual elements, and could be used for informal promotional activities or a prospect for collaboration with external institutions such as Estonian Tourism institutions.

Image 8 - Baba Yaga-inspired building

The development of the Baba Yaga folklore-inspired building was one of the most accomplished builds during the development phase. A hugely proportioned building was constructed, and there was the introduction of contemporary elements (sneakers) combined with the traditional style employed in the entire project. The texturization of the entire building was done with textures considered adequate to reflect the typical Estonian countryside wooden houses.

Image 9 - Inside view of building: class and meeting space

On the inside a number of elements were built, such as tables, benches, chairs or a blackboard. Although the informality was the primary interest mentioned by both institution and students relating to the ITK space, it was decided that it was still interesting to insert these elements.

One of the interesting possibilities is the use of the virtual blackboard to conduct distance slide or video presentations. The objects that might support these functionalities were indeed created, but their programming was not accomplished due to the lack of a support development team, which meant the compromise of one aspect in detriment of the other.

Shadow texturization was also used inside the building, in order to create a more realistic atmosphere. Although Second Life does not provide a shadowing engine for primitives, it is possible to create that effect through the texturization of semi-transparent primitives. The creation of lighting effects was also planned, but not ultimately created for the buildings under the development phase.

Image 10 - Open space

On one of the islands a number of buildings were created and texturized in order to provide the appearance of typical Estonian countryside buildings and structures. This area is open, with spaces for exploration and informal socialization, in order to allow greater freedom of navigation and exploration of the space. Some of the buildings and tools were animated using LSL (Linden Scripting Language, the internal programming language of SL virtual worlds), in order to create a more realistic and animated setting.

Image 11 - Overview of informal island buildings

Image 12 - Island for free experimentation

Other islands were created with no additional elements except for the ones that attempt to provide the 'forest' environment to all the islands. These islands were considered as crucial for the future research of the project, allowing ITK students and staff to freely experiment and learn inside the OpenSim presence.

Therefore, as of the end of the project, a reasonable number of objects were already present in these spaces, indicating that experimentation was already in place by the audiences of the project. These spaces may indicate the interest in the project continuity in the near future, and the creation of new spaces, as well as the further development of the ones already developed during this phase of the current research.

6. CONCLUSIONS

6.1. Research project limitations

The various phases of the research project described in this document had a number of limitations that conditioned, in one way or another, the end results and possible conclusions of the study. These limitations are of varied natures, both internal and external to the research project team.

By itself, the nature of the project imposed some limitations. In a collaboration project between a Portuguese institution and an Estonian one, countries with numerous differences on a varied number of levels, it was expected that a number of difficulties could occur.

In the pre-conceptualization phase, the main limitations were related to the communication channels established with the ITK. With such a geographical distance, the only way to communicate with the Estonian part of the team was through distance communication tools, in this case Skype or Second Life. Especially in the case of Second Life meetings, the dynamics of the information exchange process was slow in most cases, and in the weekly meetings the amount of data gathered was less than ideal. At the same time, the lack of experience in the usage of SL by the members of ITK demanded that the meetings took place *in-world* instead of using other channels potentially more productive, such as IM tools, where interaction could be more focused and less dispersed due to the surrounding environment of virtual worlds.

At the same time, the communication might always have been limited by cultural factors, which always difficult the interaction process.

After the placement of the researcher in Tallinn for the subsequent phases of the research project in January, it was necessary to reserve the first month to attend Estonian language and culture classes, arrange all the necessary issues related to moving abroad and get used to the country and institution. Therefore, the productivity levels suffered inevitably until the author adapted acceptably to a totally different environment from his home country.

Concerning the host institution, there were also some aspects that were less than ideal, and presented some limitations to the research project final results. The lack of experience of the staff and students in the usage of virtual worlds complicated the conceptualization and development processes. In particular, the lack of interest in the research theme by the students made the process of assembling a development team impossible during the research process duration. Therefore, the end result of the

implementation process was severely limited, as the active developers were the author of this document and a couple of members of the ITK staff.

Additionally, the inexperience of the ITK in virtual worlds led to a difficulty in defining the exact goals and ideas for the implementation part of the project, which made the whole development phase much less productive and more troublesome. And the typical approach of the ITK, being a technical institution, was itself lacking in some areas, considering the platform can be considered a social tool. This difference between the approach of the home university, in particular the Communication and Arts department (more related to the social issues of web platforms), and the one from the host university, much more technical, was a limitation in itself, demanding an adjustment to the author of this document.

The complications felt in the choice of the final platform to develop the ITK presence were also critical, considering some of the differences between Second Life and OpenSim had direct impact in the features and ideas to implement. The abandon of Second Life, justified by undeniable financial limitations, led to a reconsideration of the project concept. Concerning the platform chosen to develop the project (OpenSim), the installation of an OpenSim server in the ITK was quite problematic. The IT team of the institution had several technical problems, especially due to the concerns of the institution in the security areas (i.e. firewall access).

These problems led to a necessity to reconfigure and reinstall the OpenSim server a number of times, leading to the loss of all created content (a problem which, at least in one occasion, led to the loss of a severe amount of developed material). Only when the platform was stable enough was it possible to finally develop the results of the development phase, strongly conditioned by this process.

In the development phase itself, the limitations of OpenSim, which initially appeared to be of diminished importance, imposed a number of problems of a more severe nature than expected. As an example, the impossibility to program objects to interact with the Unique ID's of the *avatars in-world* denied the possibility to program tools and objects which would present added-value to the ITK presence.

The connection to a public grid was also inexistent, which denied the creation of a community with external developers, a possibility which could have been quite beneficial to the development process. Even for the author of this document it was impossible to access the OpenSim server of ITK from outside the institution, conditioning the implementation process to presencial situations inside the ITK.

The virtual world model itself presented a limitation, in the sense that it demands a learning process which can be perceived as very steep by non-savvy audiences. This possibility led to a smaller degree of public interest than expected.

Another point that was presented as interesting in the pre-conceptualization phase but never materialized was the establishment of partnerships with other institutions to make an improved use of an OpenSim implementation. Therefore, the gathering of active agents in the platform was even more difficult.

Regarding the methodological tools necessary to gather data, cultural and communication difficulties were also felt. A number of interviews were planned with Estonian specialists, especially regarding the specifics of the Estonian Higher Education panorama. The response of these individuals ended up being inexistent, leading to a gap of information on this area.

Finally, on a more self-reflective area, the author of this document recognizes the difficulties felt on a number of levels (culture, adaptation, communication), almost inevitable in a mobility project (especially considering ITK's lack of experience in this type of projects and its framing in a new educational scheme). Even so, it is recognized that personal pro-activity could have been stronger in certain levels, and perhaps would have minimized a number of limitations felt during the whole process.

6.2. Reflections over research results

A number of interesting conclusions have been reached during the research project here documented, regarding the background of the vectors of the research and how they influenced the implementation of the research project.

According to the theoretical framework constructed for this document, education has been documented as a complex process, with multiple elements to be considered. The individual is not alone in this process, but interacts and affects it himself. Theories such as socio-constructivism defend this stand, as well as the idea that the interaction between the learning process agents and their environment is fundamental, provoking constant changes.

The advent of technological tools applied to all everyday aspects of living have affected directly the way we think and act, how we interact with others and how we learn with them. New learning theories like connectivism have proven that knowledge is achieved through networks of nodes (human or not) and the information that flows from them.

These technological tools have transformed and evolved, accompanying the needs and expectations of people towards them, leading to the appearance of a new set of tools and technologies which have been labelled as 'Web 2.0'. Regardless of labels or terms, these are applications that reflect the ways people use technology to interact in networks, socializing, collaborating, creating and sharing knowledge. It seems apparent that education and technology converge into a similar path, following the expectations and habits of human behaviour and influencing them as well.

These new needs of the educational panorama have been addressed in the agreements that constitute the Bologna Process, and which have influenced directly the way institutions face the learning process and the roles of students and teachers. Technological tools can be applied to help these agents and institutions adapt to the Bologna Process guidelines and provide a new education system using tools that fulfil the requirements and expectations of the education agents. This is certainly one of the major conclusions of this research project, the idea that it is necessary to understand the current set of technological tools as well as the educational reality in order to develop and adopt solutions for the new learners.

Virtual worlds appear in this context, and although they are platforms which can present a steep learning curve for general public due to their difference from typical web formats, they appear to be interesting possibilities for new online environments, allowing new initiatives which can undoubtedly be applied to educational environments and institutions, as proved by many projects already conducted in this environments.

The institution in which the research was conducted, ITK, was studied in order to understand how virtual worlds could be applied for educational initiatives. ITK is characterized by technical-savvy students, with some experience in virtual worlds' usage and who are open to the idea of using MUVE's to conduct learning activities.

It is generally accepted that Second Life is one of the best examples of Multi-User Virtual Environments available nowadays, and therefore it was the chosen platform for this research project. Its financial requirements, however, led to the adoption of OpenSim, a free and open-source technology that runs Second Life-similar technology, allowing for a larger number of customization and freedom of experimentation.

According to the characteristics of students and institution, an OpenSim implementation was planned, designed and built. A number of limitations were discovered especially during this process (as explained in the previous section), and therefore the development process could have been more productive had ideal conditions applied. Still, the implementation of possible structures and spaces was

conducted, and as the research project reached an end, the ITK is now provided with an OpenSim implementation that was created to fulfil the goals ITK set in the beginning of the research. At the same time, it attempts to be a useful tool for the learners of the institution and their expectations and requirements.

The implementation of OpenSim in ITK allows for new ways to communicate, interact and learn within the institution and with external agents, and it has additionally created a new platform for ITK students and staff to investigate and experiment.

6.3. Research questions conclusions

In the beginning of the research process a number of questions were developed for which an answer ought to be provided after its conclusion. Although the previous point of this document attempts to explain these topics, the answers to these questions are now presented in a concise and clear form.

"– What implications has the Bologna Process brought to the educational agents?"

The Bologna process has modified the educational panorama by enforcing a philosophy of mobility, flexibility and standardization among European Higher Education institutions. The guidelines of the process demand students to become more autonomous, self-learners and to develop a set of competences that they can use throughout their lives, in order to constantly update their skills and knowledge, under the context of lifelong learning.

"– How can three-dimensional virtual world implementations aid the learning process?"

As technological tools that are fully embedded with social and collaboration elements, virtual worlds provide a useful environment for a multiplicity of educational activities, according to educational theories such socio-constructivism and connectivism.

In activities such as simulation, informal communication, interaction with distant agents or institution promotion virtual worlds constitute strong options among new technological tools. They are also an example of new Web paradigms, allowing the investigation of new technological and paradigmatic trends of the World Wide Web.

"– What is the place of the ITK in Estonian education, how has it adapted to the Bologna Process and which electronic tools does it use for educational initiatives*?"*

The ITK is a non-profit private institution created as a collaboration between Estonian governmental institutions, Estonian universities and technological corporations. Curricula are strongly applied in Science, Technology and Telecommunication fields.

The education model used is that of the Bologna Process (3+2), although the institution is focused mainly on the first level of Higher Education (Bachelor's Degree). The Bologna Process has been adopted early, although some of its guidelines are still being integrated.

A number of electronic tools are used for educational initiatives under ITK activities, such as instant messaging applications, collaboration tools (*i.e.* wikis, Google Docs, forums), Learning Management Systems and e-mail. Some Web 2.0 tools are being introduced as well.

"– How to create a virtual world presence for educational initiatives, according to the case of the ITK?"

In order to create a virtual world presence for educational innitiatives, it is necessary to understand the reality of the institution, its educational nature and its students' habits and expectations. At the same time, the understanding of the expectations of the institution direction and staff is fundamental, in order to establish an achievable set of goals. And finally, it is fundamental to create a development plan and team in order to successfully implement solutions inside the platform.

6.4. Future research suggestions

As the project reached an end, a number of possibilities for future projects and research seems to be possible, especially having into account that the research project described in this document was a totally new reality for the institution.

The ITK has inclusively announced that, after the conclusion of this research project, a group of students will do research in the platform as a part of their academic curriculum, although details of the nature of the research project are not known.

Research concerning the creation of functional tools inside the platform appears to be one of the logical steps to follow, especially concerning the programming of objects

and spaces was one of the aspects that was impossible to develop in this research project. Considering the ITK is a technical institution and that its students are trained in programming languages, the creation of complex spaces and tools *in-world* appears to be a great short-term possibility.

Relating to the development of objects on the visual interface areas, the ITK will probably have to develop collaborations with other institutions, which provide training, or have professionals in this area.

The research through partnerships with other institutions is, as well, a strong prospect. Although it was a possibility throughout this research project that never came true due to a number of factors, it is possible that after the implantation of the ITK initial presence the creation of such co-operations will be eased. An important factor for this possibility would be the integration of the ITK OpenSim presence in a public OpenSim grid, or the creation of a grid with educational purposes (or a consortium of institutions).

The technical approach of the ITK would position the institution as the backbone of this sort of collaboration, especially with institutions of less technological background. It would therefore be possible to create other research projects in varied areas (such as language learning, contact with mobility students, psychology) with the ITK as the development and technical partner of other institutions.

Initiatives of internal nature are also possible. The transposition of real-life environments into *in-world* models appears as a concrete possibility, such as the extension of the ITK robotics department into OpenSim for purposes like simulations and replication of models and behaviours.

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8. ANNEXES

Because of the extensive nature of the annexes, these were provided with the CD annex to the main document, inside the folder ‘Annexes’.